PUBLICATION OFFICES
168-177 POTTER BUILDING, NEW YORK.
Telephone Call: Murray 586. Cable Address: "Electrical," New York.

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VOL. XI. NEW YORK, MAY 5, 1888. No. 18.

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A Western "Round Up." THIS 52-page issue of THE ELECTRICAL WORLD contains a remarkable illustration of the activity throughout the West in electrical matters, in the correspondence and notes from a large number of busy towns and cities. Our Western representative gives week by week a very full record of all that is done in his territory, and now, with the aid of many of our friends and readers, makes a successful "round-up" of the news of the day. The coming of spring is always marked by a renewal of enterprise and work in the electrical field, especially in the West; and this special survey presents a vivid idea of activities in full swing throughout a section of the country where all is opportunity and where the throb and pulsation of commercial life is ever stronger. It will be seen that the Western outlook, electrically considered, is like that which we were recently enabled to take of the East, full of the brightest promise and encouragement. Electrical industries in all parts of the country were never in better shape, and never more rapidly extending.

Silk Fibre Suspension. FIBRE suspension presents so many advantages as a mode of support for the magnetic needle in electro-magnetic apparatus that it is well to have the difficulties which accompany its use, when silk is employed as a means of suspension, pointed out. Dr. Liebig, in another column, shows, in a striking manner, the source of the trouble and the simple manner in which it can be overcome. It is obvious, therefore, that wire suspension need not be resorted to, as has been advocated by some, in order to obtain accuracy.

Great Expectations Realized. THE report of the Commissioners of Patents for 1849, a transcript of which we give elsewhere, although it may have been strange reading at that time, shows a far-reaching discernment on the part of the writer regarding the possibilities of electric power, and he in fact enumerates in distinct terms everything that has come to pass in the last few years. We recognize in these lines—which probably he wrote—the thoughts and work of Charles G. Page, at that time in charge of the department of electricity in the patent office. But a short while before he had run his electric motor with Grove cells over the Washington & Baltimore Railroad, and he no doubt clearly saw a great future for this agent.

Honors to Sir John Pender. THE dinner given to Sir John Pender last week in London was a notable occasion. As the guest of the evening remarked, submarine telegraphy must always play an important part in peace and warfare; and the work that has been done is a great and noble one. The cables now in use would go five times round the globe, and the advocates of government telegraphs may take note of the fact that nine-tenths of them have been laid by private enterprise. We are glad to see these honors paid to a man who has been so prominent in developing this magnificent modern enterprise. This side of the water, we scarcely hold our cable pioneers in sufficient esteem.

The Copper Voltameter. AN accurate means of determining the strength of the current in electrical testing is undoubtedly a great desideratum in a variety of work; but it is rarely that workers are able to obtain instruments whose accuracy can be depended upon, and whose manipulation is easy. The electrolytic method of determining current has long been employed in such work, but it has remained unemployed for general use on account of the seeming difficulty of obtaining reliable results. The article in another column, however, shows that with ordinary precautions the results obtained are reliable to a high degree, and that the sulphate of copper, so eminently adapted for the purpose, may replace the more expensive nitrate of silver usually employed in the laboratory.

The National Electric Light Association. THE meeting of the executive committee of the National Electric Light Association here this week to arrange for the meeting to be held in the city, or near by, during the summer, was referred to on this page in our last issue as being a good augury of the success that will attend the convention. The return to New York, too, emphasizes the growth not only of the association but of the electric light industry. Just three years will have elapsed since the last meeting in the Union Square Hotel. The association was then young and struggling, and Mr. Morrison's fight for it was one whose vigor and pluck is best appreciated in looking back and seeing how much was to be accomplished in securing for this body the membership, esteem and influence that it now has under his successor, Mr. Duncan.

Methods of Measuring Light. IN the many discussions which have come up of late regarding the methods of measuring intensity of light, allusion has often been made to a possible mode of using the direct energy of light as a means of registering the quantity and intensity emitted during a given time. The action of the Crookes radiometer, though well known, seems to have been neglected, no doubt on account of the great delicacy of this apparatus; but if we are to believe the accounts of the radiograph described in another column, the results obtained with this instrument would seem to point to the fact that we can measure light energy with a considerable degree of exactness. Whether this method will find application in electric arts as the means of light measurement remains to be seen, but the subject is well worthy of study.

Arc Lamps as Plaything. SOME of the New York papers are making a great-to-do over an occurrence which they recorded last week. It appears that a young man employed on the Bowery in this city was in the habit of touching one of the arc lamps hanging outside the store in order to get a shock, and that on this occasion the current killed him. A clearer case of self-destruction could not be found, yet the critics are making it a text for denunciation, reproof and warning of the most absurd and extravagant character. Since the "accident," if one can call it by such a name, there have been several fatal explosions with gas and oil, but these are dismissed with briefest mention. Electric lights have now been in use ten years, and of arcs in this country alone there are 200,000 in use, yet the deaths proven to result from the use of the electric light all over the world fall far short of fifty, while every year sees in America scores of deaths from gas alone. Of course the arc light is a dangerous thing—no electrician denies it—but the same is true of the steam engine, the elevator, the buzz-saw, and many other agents of modern life; and all that is asked for is the use of proper precautions in connection with them. Such precautions any foolhardy person can disregard, and when he does so, and pays the penalty, the blame lies wholly in himself. As to all the talk about burying the wires, we can only remark that it has nothing to do with the case. Desirable as the putting of the wires underground is, it never will prevent such occurrences any more than the fact that the gas mains are under the street prevents Mr. Hayseed from blowing out the jet at his hotel.

The Perfected Phonograph. THE improvements in the phonograph have now been carried to such a degree of perfection that the instrument is practically ready for general introduction. Undoubtedly means will be hit upon from time to time to enhance the value and efficiency of the phonograph, but it stands to-day, in our opinion, far more practical and complete than was the typewriter when first brought out and placed on the market. Back of all the tall talk and exaggeration on the subject, for which the daily press is chiefly responsible—certainly not those who are introducing it—is a machine of admirable performance, whose utility is so wide and various that it is hard to determine just which work will give it the largest fields of employment. And then, too, aside from the practical use, is the wonder—for wonder it is—that not only can the human voice be registered, but it can be duplicated in countless electrotypes. We may be wrong, but not greatly, in believing that this century will be memorable above others because it is that which first preserved articulate speech for after time. All poetry, of every age, is full of the yearning, one of the deepest in human nature, for the voice whose gentle greeting could be heard no more; and yet this tender sentiment will be gratified, and each elusive tone and accent now has conferred on it a perpetuity that is not an attribute of even the graven stone or brass.

Practical and Economic Traction. AS we have more than once pointed out, the issue between electricity and the cable is reaching a critical stage. Our contemporary, the *Railway News*, thus views the situation: "Electricity as applied to railways has not yet been sufficiently demonstrated from a practical economic point of view to justify its being applied to any of the old lines, and so it must be tabled for the present until it has achieved its promises. The cable system is, on the contrary, a proven one, from all points of view. Its only failures have arisen from a lack of power in the machinery or injudicious economy in selecting the best manufacturers of the plant." We respectfully beg to differ, just as electricity as firmly declines to be "tabled." The opinion of Col. Flad, the eminent civil engineer, which we cited last week, as to the present superiority and coming pre-eminence of electricity for traction, may be set off against the dictum we have just quoted. Then as to the "demonstration" which electricity is alleged not to have given, it may be pointed out that there are now between thirty and forty electric roads in America alone, while in our last two issues we have given the location of nearly fifty more either building, contracted for or under survey. The new roads are averaging at present about two per week. Yet our contemporary thinks that "electricity as a railway motor has not yet issued from the stage of scientific experiment." We should be sorry to be placed on record that way.

Power Distribution in Units. IT is not so long since that a well-known electrician vouchsafed the prophesy that not only could small powers be economically distributed to a large number of consumers, but that, as a rule, even the higher quantities, even as high as fifty and one hundred horse-power, could be furnished with a profit both to the consumer and to the central station. We must confess that the proposition left a doubt in our mind as to its ultimate correctness, but recent events tend to show that the statement is destined to be confirmed. As an example of what electric power distribution can accomplish and of its ultimate effect upon the equipment of manufacturing establishments, the arrangement of the Western flour mill as described in another column cannot fail to impress the reader. We have presented here an example of a large establishment, estimated to require 50 h. p., designed and built without any local provision for power whatever, reliance being placed entirely upon the supply coming from the central station. Aside from the collateral advantages attending the use of electric motors, which have often been pointed out, we are presented with the close analogy which exists between the best methods of power *distribution* and those of power *generation*. Thus attention has again been recently drawn to the fact, already established beyond question by practice, that where the load in a generating station is variable the best economy is attained by dividing up the power generator into units which can be put into operation at the proper time and always work at maximum efficiency. Just so it is with the power to be distributed in a large establishment in which the demand for power is not uniform in all parts. Here again, by dividing up the power into suitable units to be furnished by independent motors an economy of operation is obtained comparable to that in the generating plant, and it is needless to say that no power is so well adapted to subdivision as electricity. We must acknowledge that our Western friends have, with true American enterprise, inaugurated a practice the full extent of which one is as yet hardly able to realize, but the indications are that before many years have passed the "centralization of power," in the true sense of the word, will be complete, and that in the majority of cases the use of the steam engine, save in the central station, will be the exception rather than the rule.

Galvanometer Suspensions.

BY G. A. LIEBIG, JR., JOHNS HOPKINS UNIVERSITY.

Some time ago there were in my possession several varieties of silk fibres, on which it seemed worth while to experiment, with a view of determining what treatment was best suited to fit them for galvanometer use. That treatment of some sort is necessary is perhaps evident to every one who has had occasion to use galvanometers with very delicate suspensions. The effects or defects which have been particularly noticed in silk fibres are changes in the torsional rigidity of the fibre and occasional sudden rupture of the thread without apparent reason, the latter causing often the same mishap to befall an expensive mirror.

In the *Phil. Mag.* of December, 1886, shortly after my experiments were begun, R. M. H. Bosanquet in a note on "Silk vs. Wire for Galvanometer Suspensions" calls attention to the trouble he experienced from capricious movements of the needle due to some structural changes in the silk suspension. He remarked that during certain hours of the day—generally in the early morning or late in the afternoon—the needle without any warning would begin a series of movements about the zero point, and so irregular were the vibrations, and of such amplitude, that satisfactory work with the instrument when these once began was out of the question. After various attempts to correct these faults without success Mr. Bosanquet decided to return to the old wire suspensions, and constructed a special instrument to that end. With this arrangement he stated that very good results were obtained.

In the next number of the same journal Mr. Gray criticises this note and affirms that with proper treatment of the silk fibres, and, above all, the exercise of precaution in separating the threads, no errors are introduced—at any rate for all ordinary work—by the use of silk. Mr. Gray has determined the torsional rigidity of silk threads, and shows that there is no reason why silk should be abandoned even for the most sensitive astatic galvanometers. For instruments of great sensibility the rigidity of the fibre may become an important quantity, but by strengthening the magnetic field in which the needles move and increasing the length of the suspension, the error due to this cause may be reduced to a minimum. For astatic galvanometers there is no danger of considerable errors as long as the difference in the magnetic fields in which the needles are suspended is more than $\frac{1}{10}$th the mean horizontal intensity of the earth's magnetic force.

As far as structural changes go, the condition of things would scarcely seem to be improved by the employment of metal for suspending magnets. The wire is certainly more easily influenced by a permanent set, especially if long deflected from zero, than a silk thread would be, and it would be very difficult to allow for.

In the case of silk thread these "structural changes" can be cured or rendered negligible at any rate, and the process thus involved seems to have the effect of increasing the tensile strength of the material.

I think the sudden rupture of the thread and unreasonable oscillations about a changing zero can be explained in this way. The ordinary cocoon fibre consists of an inner mass or core similar in structure to hair or horn, insoluble in water, alcohol and dilute acids; and an outer layer of gummy substance of a gelatinous nature, which dissolves readily in hot water or dilute alkalies. The latter constitutes about one-third the mass of the fibre. Now if the fibre is exposed alternately to damp air and dry air it seems reasonable to suppose that the external covering, changing from a soft to a hard, brittle mass, gradually weakens the inner core until it can no longer support the suspended magnet and attachments and breaks. It seemed probable therefore that if by any means the gelatinous covering of the fibre could be removed without injury to the inner structure, the fibre would be greatly improved.

The silk examined was of four kinds, namely, Chinese cocoons, a mass of fibres arranged in a circular disc, American cocoons, and a variety of silk known as "tussus;" this was already reeled.

The second variety was peculiar. The silk was arranged matted together in the form of a circular disc about four inches in diameter, and perhaps a twentieth or thirtieth of an inch thick. The mat was of a yellowish color, and the fibres were rather closely packed, yet not so closely as to prevent long threads from being drawn from the mass. I have not been able to find a description of this kind of silk, but am informed by the gentleman who gave me the mat that the "silk-worms are trained to spin their product in such a form," a statement which would indicate a possible educational development of the silk worm to such an extent as to render dressmakers a useless species.

The variety known as tussus is not at all uncommon, this being in reality only another name for pongee silk. The tussus threads are exceptionally tough and strong, and very much thicker than ordinary cocoon fibre. A single thread of pongee silk can easily support a weight of from five to seven grammes, whereas ordinary silk threads reach their limit at about two grammes.

The examination of the silk was conducted in the following way: After drawing fibres of the desired length from the cocoon, they were split up into their two parts. Cocoon threads are always double, and as the two halves are occasionally well glued together, it becomes necessary sometimes to dip the fibre in hot water in order to effect the separation. To the threads were then fastened pieces of copper wire to act as weights, which, having a very small moment of inertia, allowed the threads to untwist themselves without difficulty. The threads were then hung up inside glass tubes and steamed from fifteen to twenty minutes, after which they were dried and fastened to hooks inside a large rectangular box with glass sides.

Side by side with the steamed fibres were hung up a number of threads which had not been steamed. Small pointers were attached to the weights, and beneath these were a series of circular scales by which the extent of untwisting or twisting of the threads could be measured. The positions of the pointers having been observed, the air in the box was alternately dried and rendered moist by pumping into the box air which had previously been passed over calcium chloride or water. This was done very carefully and slowly, so as to avoid setting the fibres in vibration. Some of the motion which resulted may have been due to the mechanical movement of the air; but to eliminate as far as possible errors from such causes the fibres were moved from place to place in the box, so

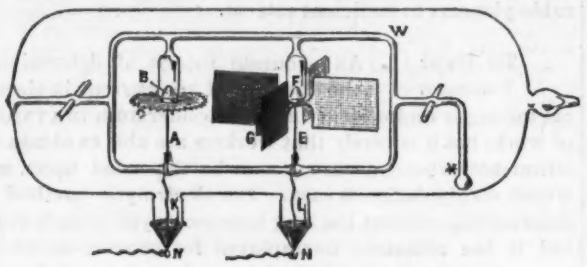


FIG. 1.—THE RADIOGRAPH.

as to be equally exposed to the action of the air currents; but the effects were nearly always of one kind.

In a few minutes after making the air damp the fibres began to vibrate or untwist. After a few revolutions in one direction a rotation in the opposite direction ensued, and many of the unsteamed fibres broke. Very few of the treated threads gave way, but a large proportion of the unsteamed fibres suddenly parted. It was also noticed that, although both kinds of fibres turned, at first, perhaps several complete revolutions, when the air was changed from dry to damp, the excursions of the treated threads became gradually less as the process was repeated, and finally became negligible, while the others scarcely diminished their vibrations. When the box was exposed to sunlight directly, the untreated threads would begin to vibrate and frequently make several complete revolutions in one direction, whereas the treated fibre seemed to be unaffected.

On steaming the silk it was observed that the threads lengthened themselves considerably, the change amounting to ten or fifteen per cent. of the length. The steaming had very frequently the effect of rupturing the threads, which always untwisted themselves as soon as they became wetted.

Instead of steaming them, a number of the fibres were immersed in a very dilute solution of caustic alkali, one part in forty or fifty, and afterwards in dilute acetic acid to neutralize the alkali clinging to the thread, and also to ex-

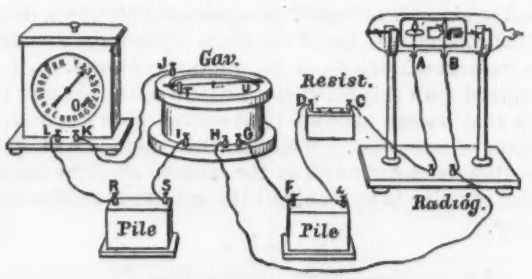


FIG. 2.—THE RADIOGRAPH.

ert a solvent action, for about the same length of time, in general a few hours. They were then washed in pure water. It was thought that the acid and hydrate would more effectively dissolve the outer coating of the silk thread and thus still further improve them. However the method seemed scarcely an improvement, all things considered, over steaming or careful and thorough washing in hot water, and, after all, the latter accomplishes about everything that could be desired.

Although the outer covering and gummy substances surrounding the fibre proper are probably responsible in a great measure for whatever trouble silk suspensions may cause, there is no doubt that in many cases the irregularities can be traced to the failure of separating the threads, so that, in reality, the magnet is supported by a double instead of a single fibre.

A New Form of Secondary Battery.

BY J. D. DALLAS.

The following is an interesting form of secondary battery described by M. Tinot, of Paris:

The negatives are formed of tinned iron wire netting. The positives consist of pure porous copper obtained by subjecting electrolytic copper to a pressure of several tons to the inch. The positives are wrapped in vegetable parchment, being separated from the negatives by india rubber plugs. The whole is immersed in a solution of zincate of potash or soda in a tin box.

On charging this accumulator, the zinc is deposited on the negative plates, while the positive copper plates are either partially converted into a suboxide of copper or the oxygen is occluded. On discharging, the zinc is redissolved and the copper loses its oxygen.

The Radiograph.

One of the principal difficulties met with in photography is the proper determination of the time during which the sensitive plate shall be exposed to the light, and, until recently, this has been determined only by trial, aided by experience. In order to avoid this difficulty, M. Louis Olivier, some time ago, proposed a method of timing the exposure by the indications of a chemical action due to the actinic rays. This method, however, did not prove satisfactory, and as a last resort he turned to electricity, with eminently successful results. The apparatus which he has devised consists of a radiometer, the speed of which he has shown by experiment is exactly proportional to the intensity of the light, and the number of revolutions during a given time serve to indicate a definite amount of light effect. The radiometer which is designed for this purpose is shown in Fig. 1. As will be seen, it consists of the usual form of vanes, one of which is provided with a projection *G*, so that in the course of each revolution this projection makes contact with the toothed disc *C* placed opposite it and in its path. This toothed wheel is mounted on a pivot similar to the vane itself, so that it presents practically no resistance to the revolution of the vanes. The cap *F* of the vane is made of hardened steel, and is connected through the pivot with one terminal *N*. The metallic vane *G*, when it strikes the disc *C*, closes the electrical circuit for an instant, which is then completed by means of the pivot *A* upon which the disc *C* is mounted, and which communicates with the terminal *M*.

The manner in which the apparatus is employed for timing the exposure of a photographic plate, or any other similar purpose, is shown in the diagram, Fig. 2. Here the two terminals *A* and *B* of the radiometer are connected to the poles *E F* of a battery. In this circuit there is placed the resistance *C D* in order to regulate the current passing through the galvanometer *G H*. Another terminal, *I*, attached to the galvanometer, is connected with the metallic pivot which supports the galvanometer needle *T U*, so that every time a current impulse passes through the galvanometer the deflected needle is thrown against the stop *J*, and closes the electric circuit. The terminals slit are connected to another battery *R S* and a dial receiver *L K*. In this way it will be readily understood that every revolution of the mill wheel in the radiometer causes the pointer of the dial to advance one step, and by placing step *O* in the path of the pointer of the dial, any electrical device can be operated by the contact thus made. In this way an exact amount of light action can be obtained, no matter what the intensity of the light may be. It is evident that with strong sunlight the vanes in the radiometer will rotate rapidly, and cause the dial pointer to advance step by step, in proportionately rapid ratio, whereas with a lesser intensity of light, the vanes will not revolve so rapidly, and the pointer will require a longer time to reach the step. The amount of actinic action, however, in every case will be the same, which is the object which it is desired to attain.

This ingenious apparatus, described by M. Olivier in *La Lumière Electrique*, is considered by the author to be very useful, in photography, having been in use for some time in that field with eminent success, but he considers that for the use of meteorological observatories the instrument will also prove of value, in order to determine the total amount of radiation, and to record its variations during the day.

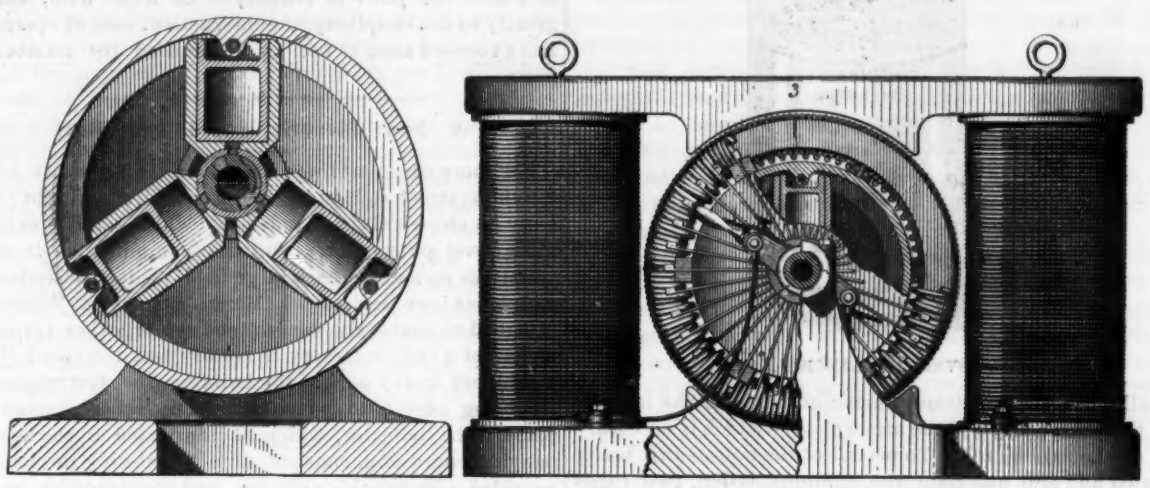
Demonstration of the Laws of Static Electricity.

On the evening of April 27 last, Prof. Alfred M. Mayer delivered a lecture at the Stevens Institute of Technology before a large gathering of the New York Electrical Society, in which he demonstrated by some novel and simple apparatus the laws of static electricity and kindred subjects. These embraced first the measurement of the attractive and repulsive force exerted between charged bodies and the demonstration of the law of inverse squares as developed therefrom. The apparatus employed for the purpose was in the form of a pendulum arrangement, gravity being employed as the opposing force instead of torsion, as employed by Coulomb in the torsion balance. The same apparatus can be employed to demonstrate the law of the dispersion of electricity.

Another interesting subject treated by Prof. Mayer was the ocular demonstration of the different specific inductive capacity of various bodies. This was accomplished by inserting the various substances, such as glass, paraffine, etc., between two charged plates and measuring the difference in distance between the two necessary to bring about equal attractions. Various other laws were demonstrated, and the value of the dyne was vividly brought before the eyes of the audience. The evening was a delightful and memorable one.

A New Steam Dynamo.

The direct connection of dynamo-electric machines to the engines which drive them presents so many advantages that a number of efforts have been made in the past to combine them, and one of the first instances of this method was the direct connected "Jumbo" of Mr. Edison. Later on these direct connected plants came quite in vogue for employment on ship board, where the matter of space was especially to be considered. All these arrangements, however, still retained the engine entirely distinct and separate from the dynamo itself. In order to still further consolidate these two machines, that is the engine and the dynamo, Mr. Richard H. Mather, of Windsor, Conn., has designed an arrangement in which the steam engine is entirely inclosed within the dynamo. Our illustration, Fig. 2, shows a front elevation of the machine and the armature in part section exposing the interior construction. As will be seen, there is placed within the armature, which is of the Gramme ring type, an engine having a number of cylinders, as shown in Fig. 1. Steam is admitted through the hollow shaft at one end and the exhaust passes out at the other end of the hollow shaft. By the arrangement here shown the inventor hopes to still further diminish the space occupied by a dynamo and its motive power.



FIGS. 1 AND 2.—A NEW STEAM DYNAMO.

A Western Flour Mill Operated by Electric Motors.

We have already mentioned in these columns that the Laramie Milling and Elevator Company's flouring mill is operated entirely by electric power, and a recent description of the plant, given by Mr. R. M. Jones, the manager, contains some valuable data and hints on this method of power application to this particular purpose.

The mill is a fine specimen of design and workmanship throughout. Its capacity is 100 barrels of flour per day, and it turns out work in this proportion regularly, without crowding. The building is of stone, 36 × 48 feet inside, and is four stories high; basement 10 feet, first floor 12 feet, second floor 13 feet, and third floor 14 feet 6 inches between joints.

The mill is equipped with steam heat, the Edison electric light and Sprague electric motors. These motors are used exclusively for the power to drive the mill. There is no engine or boiler house about the place, as it was intended from the first that motors should be used, and since the mill has been in successful operation for more than a month, and as all parties interested are entirely satisfied with the power now in use, it is not probable a change will ever be made in this respect. The mill machinery consists of seven double sets of rolls 7 × 18 inches each, with purifying machinery of a capacity equal to the rolls. The system is the "gradual reduction," and, according to Mr. Jones, produces results as to yield and quality of product equal to any mill of like capacity in existence.

The power is divided in units of 25 h. p. each. One motor in the corner of the building, as shown in the accompanying engraving, drives all purifying machinery on the floors above, also the wheat (cleaning) machine, and all elevators and conveyors, which, if they were all stretched out in one line, would measure over a mile in length. The other motor runs the seven double sets of rolls and the flour packers.

From the experience gained, Mr. Jones would advise mill builders who use electric motors to sub-divide their power into three units, by taking all wheat cleaning and scouring machines, and all elevators and conveyors running directly in their interest, from the purifier line, and to apply a motor of proper capacity directly to them by means of a countershaft. This he would suggest, owing to the intermittent use of these machines, especially where the wheat-dampening process is used.

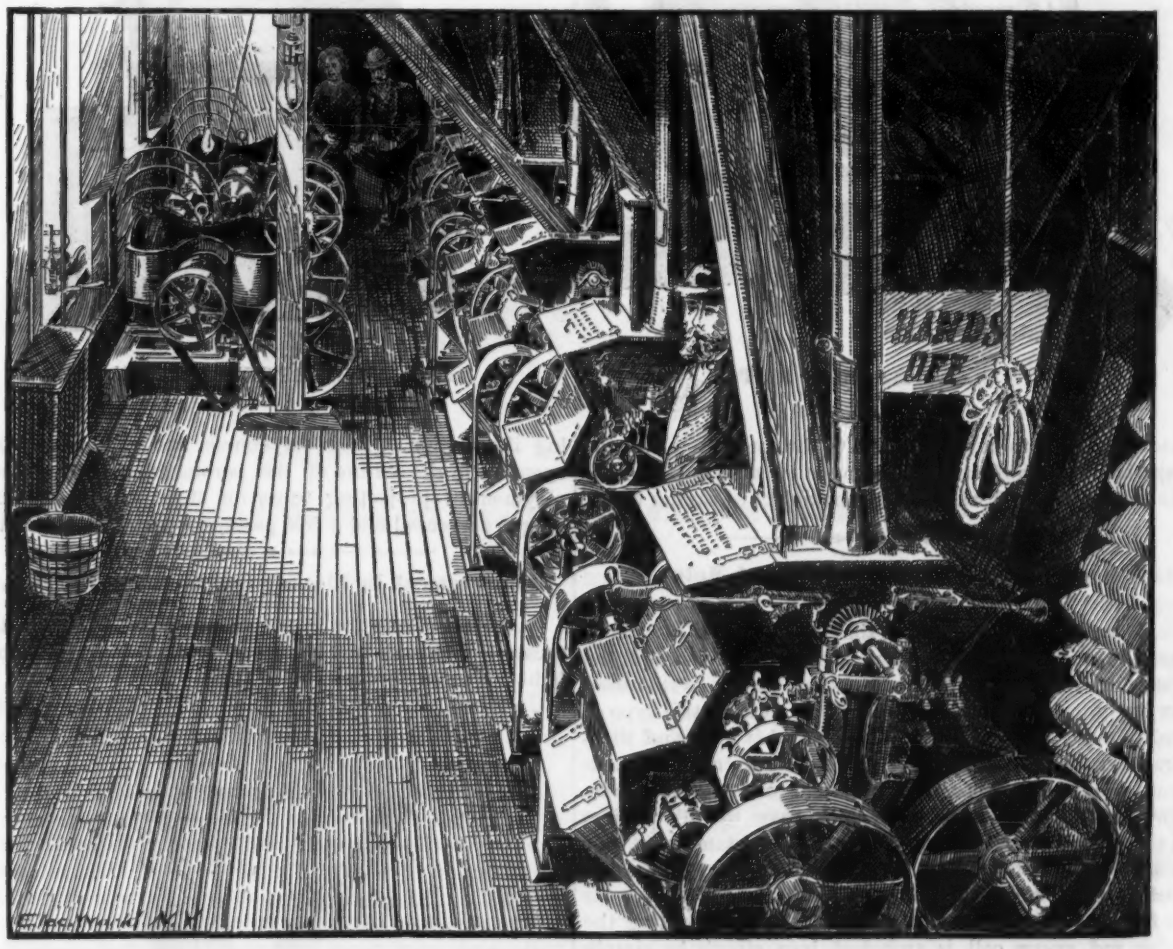
As to the arrangement of the Laramie Mill, with all the power on the roller floor, one motor belted up through one floor to the purifier line, and the other belted to the roller line, he maintains that he has a lower percentage of loss of indicated power on the engine cylinder in the generating station (including the friction of generating machinery and the various resistances and other losses) than he would obtain from an engine placed in a building prepared for it alongside the mill, counting the necessary loss by friction in running long shafting and belts, as is invariably done. The arrangement just suggested, a subdivision of power into three units, would reduce the friction and be preferable, as cleaning machines could remain idle much of the time; and besides the present quantity of shafting and belts would necessarily be reduced.

The motors in the Laramie Mill run at constant speed. In fact, Mr. Jones states, they are more constant as to any sudden change than the best regulated automatic engines in the market. The only change they are subject to is a gradual, but slight, increase in speed from the time of starting until the day's run is complete. This increase appears to be due to an increase in the temperature of the armature, and has been found to be in these proportions: Thus at starting, the roller line shaft makes 219 revolutions per minute, which is the right speed. At night the speed has increased to 224 revolutions, and at intervals during the day the speed varies in almost true proportion, which result is more uniform than engines will give.

The motors are wound for 220 volts, but are run at 226 volts, and it requires in current an average of 150 ampères to drive the mill to its capacity. A variation of pressure on these machines will vary the speed in about the same proportion as steam pressure will vary the speed of the best engines. So far as observed, a variation of one volt electrical pressure will produce about the same effect on the motors as one pound of steam pressure would vary a good automatic engine. However, it is easy to control electrical pressure to within one or two volts, while it is difficult to control steam pressure within the limit of a few pounds, which shows that the motor is superior as to variable changes in speed.

Mr. Jones has recently placed a 20 h. p. Sprague motor in the Laramie Rolling Mills, which now runs about 120 feet of 3-inch shafting, containing many heavy pulleys. This shaft drives four spike machines, two bolt headers, two nut presses and a large quantity of threading and tapping machinery, including some emery heads. It takes less than 20 h. p. to drive this shaft, and it delivers a uniform speed to all machines. Previous to placing this motor the power was transmitted nearly 800 feet by belts and shafting; and probably required nearly 50 h. p. to do the same work now done with less than 20.

It is also known that at the rolling mill the men are doing one-half more work now than by the old belt system, owing to the fact that during much of the time speed was so slow, caused by low steam, that machines had to be shut down.



A LARAMIE, WYO., FLOUR MILL DRIVEN BY SPRAGUE MOTORS.

The Electric Motor in 1849.

The following extract, taken from the Patent Office report of 1849, has been communicated to us by a correspondent. The article is entitled "Electric Motors," and shows what great possibilities were even then anticipated of electricity as a motive power:

"The belief is a growing one that electricity, in one or more of its manifestations, is ordained to effect the mightiest of revolutions in human affairs. In subtlety and power, in excitability, rapidity, and intensity of action there is nothing like it. Its complete subjugation may be held as the climax of conquests in art, the apex of ambition in science—so blessed and boundless, so surpassing all anticipations, are the seeming results that must follow. When, in addition to what it is now performing as a messenger-one, swifter than those of the gods, and more reliable than the boasted Ariels of poets—it can be drawn cheaply from its hiding-places, and made to propel *land and water chariots, animate manufacturing mechanisms, become an agricultural laborer, and a household drudge of all work*, then we may begin to think the genius of civilization is vaulting rapidly toward the zenith.

"Several years ago the discovery of electro-magnetism awakened sanguine expectations that in it would be found a prime mover so compact and energetic as to be adapted to general purposes. No sooner was the fact made known that soft iron is rendered intensely magnetic by the galvanic or voltaic pile, than hosts of mechanicians in both hemispheres were at work endeavoring to transmit the enormous power thus developed to motive machinery. Though exhibited in a variety of apparatus, the principle by which motion is obtained from it is the same in all; one or more magnets are fixed and serve as fulcra on which others turn. Thus Professor Henry first produced reciprocating motion, by arranging an electro-magnet in the manner of a balance-beam above the opposite poles of two permanent magnets, keeping up oscillation by alternately breaking and renewing the connection with the battery.

"Rotary motion is attained by so arranging two circles (or portions of circles) of magnets, one within the other, that the faces of those which revolve may sweep round those that are immovable, and as near as can be without touching. By a series of cut-offs, the stream of electric fluid is alternately let on and excluded, so that each face of a revolving magnet is pulled in succession toward each of the fixed ones, and as it passes is pushed away toward the next.

"While in some machines permanent are employed in connection with electro-magnets, in others, the latter only

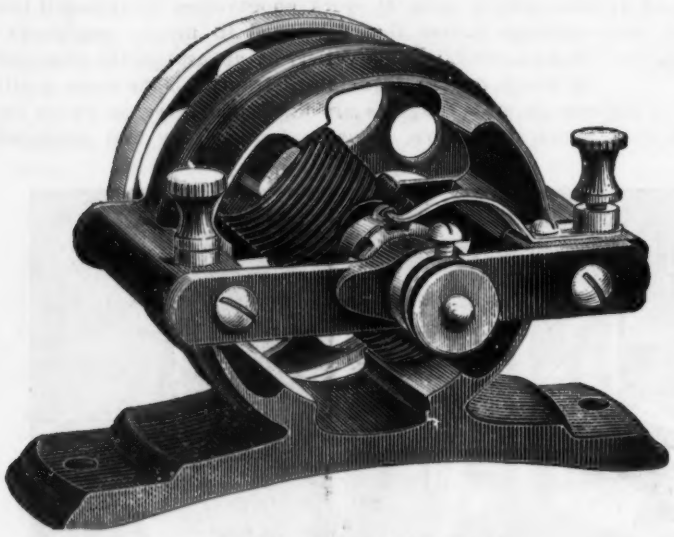
are used. Change of polarity is abandoned in some, and with it the repellant force; the bars being rapidly magnetized and de-magnetized by opening and closing their connection with the battery.

"In 1838, Jacobi propelled a small shallop with fourteen men on the Neva at the rate of four miles an hour, three against the stream. He had four fixed electro-magnets, and the same number of revolving ones, to which the axle that carried the paddle-wheels was attached. His battery, consisting of sixty-four pairs of platinum plates, each presenting a surface of thirty-six square inches, was charged with nitric and sulphuric acids, on Grove's plan. Since then innumerable modifications of the apparatus have been devised; lathes have been worked, and articles of wood, ivory, and metals, turned; a printing press operated, and a locomotive weighing five tons propelled, etc., etc. But these experiments, interesting as they certainly were, have brought out no marked results, nor afforded any high degree of encouragement to proceed. It might be imprudent to assert that electro-magnetism can never supersede steam; still, in the present state of electrical science, the desideratum is rather to be hoped for than expected.

"Great, however, will be his glory who in the face of these discouragements succeeds.

"The talent for inventing new modes of employing forces is great, but that of discovering new motors, and applying them to the general purposes of engineering is far greater. One is somewhat common, the other rare. A new power is now wanted, is looked for; and what a field of enterprise will its introduction open. Every department of mental and physical existence will be benefited by it. Steam has wrought gloriously, and equal changes for the better will be wrought by that agent which displaces it, or which takes a place beside it."

How true the foregoing, and particularly the first part of the above quotation is, it is hardly necessary to state, for we have to-day not only electrically propelled vehicles of all descriptions, including boats, but we have the electric



NEW RAUDA MOTOR.

motor adapted to numerous uses in the commercial world, applied to manufacturing purposes of all kinds as well as to uses designed wholly with the object of saving labor.

Combination Grenet Battery and Motor.

Notwithstanding the fact that other forms of battery have in many cases taken the place of the Grenet cell, the latter, on account of its handiness and power, is still used in many instances. In a new arrangement of this type of cell devised by Mr. Otto Rauda, of this city, and illustrated in the engraving, the elements are all fastened to a hard rubber plate and held to the glass jars by two brass knobs, making it very easy to fill the jars and replace the elements. The glass jars stand on a very elastic soft rubber plate, pressing them tight to the soft rubber sheet which is fastened beneath the top plate.

By a new construction of the metal parts holding the zinc rod, every cell is switched into circuit by simply lowering the zinc into the fluid. In the cells which are not used the zinc remains out of the fluid, thereby saving unnecessary consumption of zinc and fluid. It is not necessary for the cells in use to follow in rotation, as they may be selected and set in use, no matter where they are located in the battery. Should any single cell become exhausted or disabled, it will not interfere with the rest of the battery. All these effects are obtained without handling a switch or a changing of connections, the two end wires or conductors always remaining in the same two terminals.

As will be seen, the cell is also provided with an adjustable resistance coil, placed on the cover, which regulates the strength af the current according to the position of the knob, which can be drawn in and out.

Mr. Rauda has also designed a small motor, shown above, which can be operated by two cells of battery, and can be used to run small fans, Geissler tubes, models, etc.

Improved Leclanche Battery.

The Improved Patented Porous Cup Battery Company, of this city, have recently brought out a Leclanché cell embodying an improvement made by the manager of the company, Mr. C. J. Hirlimann. The principal improvement consists in the providing of means by which there

AN IMPROVED LECLANCHE BATTERY.

shall always be free communication between the interior of the porous cup and the atmosphere—which is necessary in the Leclanché cell. To permit of the porous cup being sealed and still maintain the communication, two tubes are inserted in the cup which extend some distance below the sealing material and can be seen projecting some distance above the glass cover, as shown in the accompanying illustration. It is, of course, not new, to provide openings in the sealing of the porous cup but by the employment of projecting tubes for that purpose all clogging is prevented and a free passage is assured for the air.

ELECTRIC SPEED INDICATOR.

Improvement in Electric Gas Lighting Burners.

In the use of gas for illuminating purposes, one of the greatest essentials contributing towards a satisfactory light is a properly constructed tip.

Up to within a short period, all burners supplied with

IMPROVED ELECTRIC GAS LIGHTING BURNER.

electric igniting devices have been constructed with lava tips only. This has proven a great drawback to their use in many localities, as they have incurred the enmity especially of the water gas companies; and further, the breakage or chipping of the edges of the slot in the tip has rendered the burners useless, unless an expert was called in to replace them with new tips with properly adjusted electric connections.

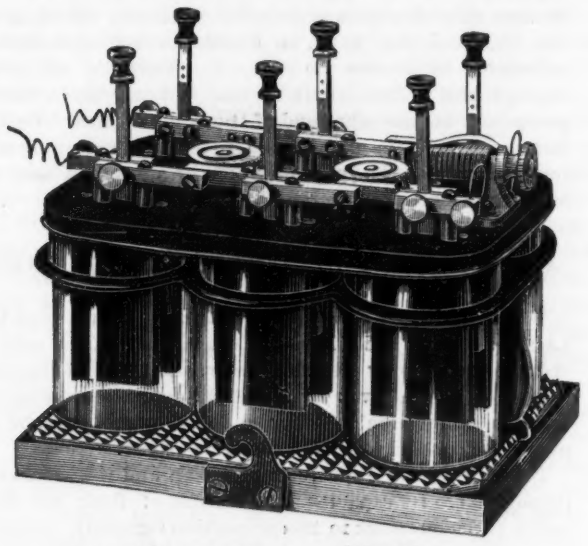
Mr. A. L. Bogart, of this city, who had long employed the nickeled iron tip in theatre work in connection with his multiple electric gas-lighting apparatus, has lately constructed the "hand-lighting" burners shown in the accompanying engraving in such manner that the iron tip is made use of instead of the lava. This overcomes the objections above stated, and renders the burner adapted to any form of gas, and makes the tip substantially imperishable, whether in use or when subjected to rough handling in shipment.

These burners include some other novel features, amongst which is the peculiar form of ratchet movement, in which the pawl is entirely done away with, adding greatly to the simplicity of construction, ease of operation and extended time of use by minimizing the number of parts.

A New Electric Speed Indicator.

For some time past there has been in operation in the Stanhope street station of the Boston Electric Light Company an electrical speed indicator which embodies some quite novel arrangements and whose application in other situations seems to offer a large field. This speed indicator which has been devised by Messrs. Stevens & Wescott is designed to enable the superintendent or other person in charge of a mill or factory to readily test the speed of the machinery in any part of the building, the instrument itself being placed in his office or any other convenient place. The indicator, which is illustrated in the accompanying engraving, consists of a registering mechanism provided with suitable switches and connected by proper circuits to a number of contact-changing devices located at, and operated by, the various pieces of machinery the speed of which it is desired to know.

The registering device consists of a large dial provided with two hands of unequal length, the longer arranged to indicate single revolutions, and the shorter moving through one division for every hundred revolutions of the shaft. Beneath the large dial is a smaller one furnished with a hand which makes one revolution per minute and which gives the division of time. The clock work which rotates this minute hand also operates a device which automatically starts and stops the registry mechanism. Below the dials will be seen a row of contact buttons connected with the wires leading from the various pieces of machinery, so that by pressing any one of these buttons the corresponding machine will be put in connection with the registering device.



NEW GRENET BATTERY.

The operation of the system is quite simple. When it is desired to determine the speed of a certain shaft, the corresponding button is depressed; then at the beginning of the next even minute the registering device will automatically start and continue for exactly 60 seconds, when it will automatically stop, and the hands of the large dial will show the number of revolutions made by the machine in that minute. If it is desired to obtain the average speed during a longer period, the device may be set by means of a switch so as to be run any number of minutes and thus a close average may be obtained. The current for operating the device may be obtained from a battery, but the inventors have replaced the latter by a small dynamo run at a comparatively low speed and which requires practically no attention.

Dimensions of Arc Carbons.

According to the *Revue Scientifique*, the most advantageous thickness of carbon for arc lamps, taking the currents specified, is given in the following table:

Current in ampères.	Diameter of carbon in millimetres.	Current in ampères.	Diameter of carbon in millimetres.
2 to 3	2	15 to 24	13
3 to 5	4	16 to 25	14
4 to 6	5	25 to 30	15
7 to 10	7	30 to 45	17
10 to 11	9	35 to 60	18
11 to 15	10	40 to 80	20
12 to 16	11	50 to 120	25
13 to 20	12	80 to 180	30

For heavy currents, our contemporary recommends bundles of carbon rods of 4 mm. diameter or fluted carbon rods.

Carbons for Arc Lamps.

The manufacture of arc light carbons forms an industry of considerable magnitude, and the works of Herr Hardtmuth, Döbling, says *Industries*, are now turning out about 3,500 metres of carbons daily. Some improvements have recently been made in the process of manufacture, under which the homogeneity and density of the carbons are increased. These refer more especially to cored carbons. As usual, the rod of plastic material issues from the press in the form of a tube, and after drying and baking, the carbons are steeped in a heavy hydrocarbon, by which the pores left after the first baking are filled. The carbons are again baked, and the core is then inserted under a pressure not much greater than that of the weight of the plastic mass forming the core. In connection with this factory is a well-equipped electrical laboratory for the testing of arc lamps. There are dynamo machines by various makers—viz., Pöge, of Chemnitz; Kremenezsky, Mayer & Co., of Vienna; Krizik, of Prague, and Siemens and Halske (alternator). The reason for installing various dynamos is to be able to test any lamp which may be sent to the laboratory. There is also a spectroscope for determining the elements contained in the carbon from the spectrum of the arc, and the laboratory is equipped with the usual electrical measuring instruments and photometers. The work at this laboratory is done on a thoroughly scientific basis, and both lamps and carbons are tested so as to determine the best quality of carbon to be used for each type of lamp.

The New Bernstein System of Series Incandescent Lighting.

The use of incandescent lamps in series has of late been attracting especial attention and many devices to guard against the circuit being opened through the breaking of a lamp have been produced and more or less extensively used.

The Bernstein Electric Light Manufacturing Company, of Boston, very early advocated the employment of low resistance lamps, and it has naturally paid especial attention to developing appliances for using its lamps in series. It has successfully introduced for that purpose several devices which have been largely used by arc-light companies desiring to run incandescent lamps on their circuits without special wiring; these devices have been simply different methods of using electro-magnetic mechanism for keeping the circuit closed, and while they have served their purpose they have also shown that something less complicated, cheaper and more reliable was needed, and this demand the company now claims to have fully met with the automatic cut-out and lamp shown in the accompanying illustrations.

The cut-out proper is that designed by Mr. Bernstein and was described in our issue of Feb. 11, 1888. The socket and the lamp have been especially constructed to meet the many exacting requirements of high potential circuits and they present several new and interesting features.

The cut-out or, as it is specially designated, the "contact," is shown in Fig. 1. It is so arranged that when the current is through the lamp the contact is a shunt around it, being in electrical contact, by means of the binding posts in the socket, with both of the terminals to the lamp. It consists, primarily, of two conducting pieces electrically separated by two insulating strips and electrically connected by a compound of very high resistance, which constitutes the shunt; upon the breaking of a lamp the resulting increase of temperature instantly so reduces the resistance of the shunt that a free path for the current is provided and at the same time the two conducting pieces are brought into direct contact by the pressure of a spring which forces one of them through the now softened compound. After a "contact" has served its purpose it is withdrawn from the socket and replaced by another; the "contacts" may be re-adjusted and used many times. The "contact" is also used as the "off and on" key to the lamp, excepting in the case of the 100 candle-power lamp, for which a separate switch is required.

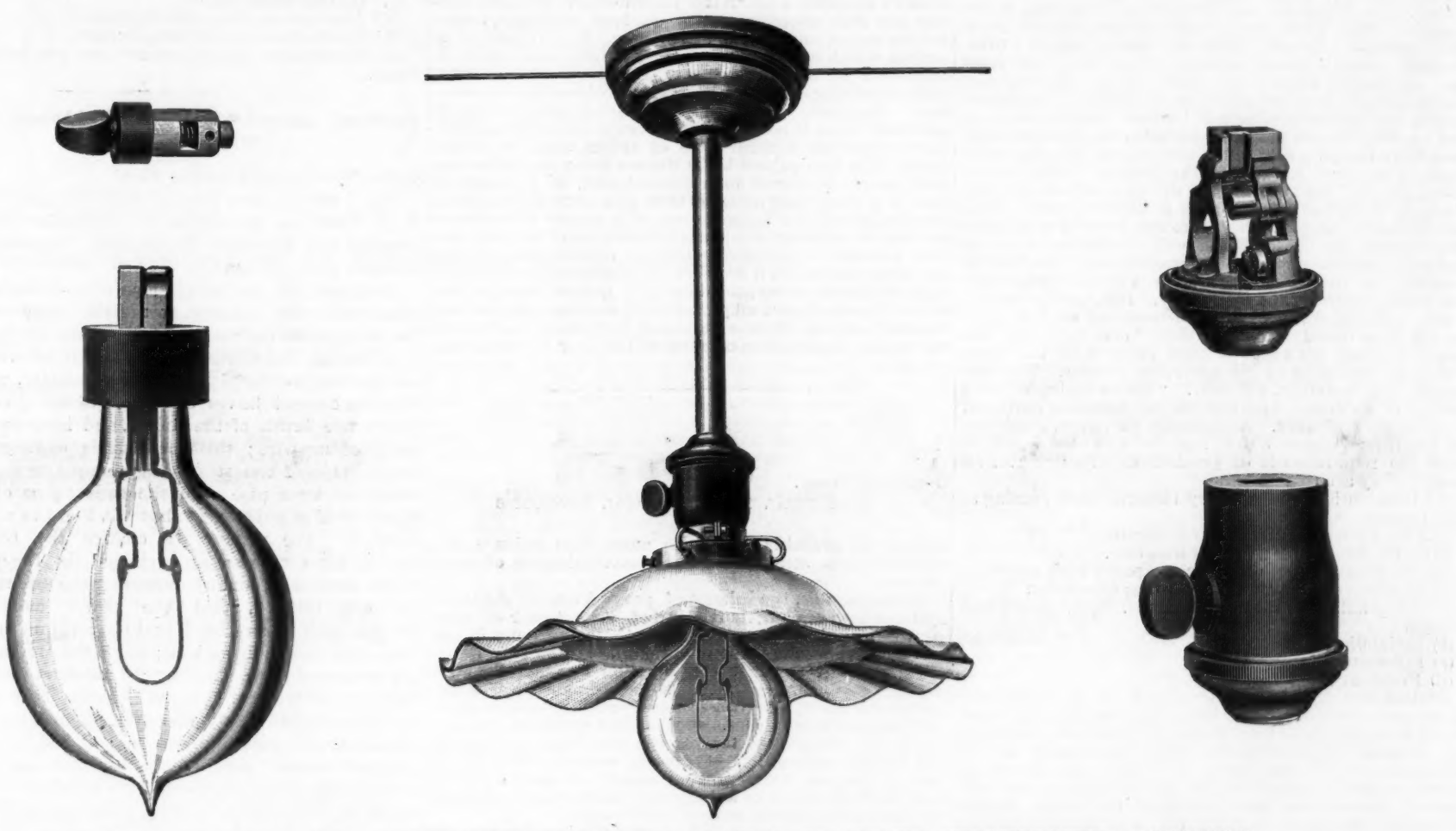
The internal construction of the socket, Fig. 2, is such that it is impossible to open the circuit by the withdrawal of either the "contact" or the lamp, or both, as the binding-posts are provided with two pairs of short-circuiting arms, one pair for the lamp and the other for the "contact." When the lamp is placed in the socket the pressure of its terminals breaks the connection between the binding-posts made by its pair of short-circuiting arms, and when the "contact" is placed in the socket and its handle turned to the "on" position, it, in turn, breaks the connection made by the binding-posts made by its pair of short-circuiting arms, and the lamp is in circuit. When either the lamp or the "contact" is withdrawn from the socket the action of the short-circuiting arms is reversed and a short-circuit between the binding-posts is established by the one or the other pair.

Fig. 5 shows the socket, or as it is especially and appropriately designated, the "combination-socket," complete and ready for the lamp. The lamp, which is of especial construction to adapt it to the heavy currents with which it is used, is shown in Fig. 4. All the conducting parts and contact surfaces of the switch are unusually large, so that no injury may result from the heating caused by the use of heavy currents, and in order that there may be absolute freedom from any danger resulting from the use of high tension currents, all the outside parts, both of socket and lamp, are of insulating material.

The socket is very compact, being scarcely larger than the ordinary key-socket, and it seems to be well adapted to the purpose for which it has been designed.

Fig. 5 shows a complete fixture, combination socket, lamp, shade and pendant.

The system appears to be especially adapted to street lighting for large and small towns and for all cases requiring distribution over a large territory; it is also adapted for use in connection with arc-light circuits and it is stated that many such lamps are being run in direct series with arc-lamps.



FIGS. 1, 2, 3, 4 AND 5.—THE NEW BERNSTEIN SYSTEM OF SERIES INCANDESCENT LIGHTING.

Motors for St. Paul, Minn.—The Exhaust Ventilator Company, of Chicago, have the contract for ventilating the Minnesota State Capitol building at St. Paul and have awarded the contract for the three-quarter horse-power motors to the Hawkeye Company, of Oskaloosa.

Uses of Mica.

The peculiar physical characteristics of mica, its resistance to heat, transparency, capacity of flexure, and high electric resistance, adapt it, says *Engineering*, to applications for which there does not appear to be any perfect substitute. Its use in windows, in the peep-holes on the furnaces used in metallurgical processes, as well as the ordinary use in stoves for domestic purposes, are examples of its adaptability to specific purposes which it does not seem to share with any other material. Recently there has been introduced in America a type of watch in which the plate covers about three-fourths of the works, and the remaining portion over the balance wheel and attendant mechanism is protected from exposure when the watch is open by a thin covering of mica. The inclosure of the mechanism of the watch is rendered still more perfect by a ring which is placed around the works before they are inserted into the case. Its fitness for use in physical apparatus is represented by its application for the vanes on the coulomb meter recently invented by Professor George Forbes, F. R. S. For electrical purposes mica has proved useful, acting as an insulator between the segments of commutators of dynamos and safety fuses in lighting circuits, also as the base part of switches handling heavy currents, to obviate the danger of ignition by the arc formed when the switch is changed. For this latter purpose it shares the field with sheets of slate. Both of these uses were first suggested a number of years ago by an insurance expert in America, in the course of regulations governing the safe installation of electric light plants. As a lubricator mica answers a very peculiar purpose for classes of heavy bearings, where the powdered mica serves a useful office in keeping the surfaces separate, thereby permitting the free ingress of oil. It is used in roof-covering mixtures in a powdered condition in combination with coal tar, ground steatite, and other materials, its foliated structure tending to bind the material together. Not affected by ordinary chemicals which are corrosive to many other substances, it has been applied in the valves to sensitive automatic sprinklers, where a sheet of mica placed over a leather disc has proved to be non-corrosive, and without possibility of adhering to the seat, while the leather packing rendered the whole sufficiently elastic to provide a tight joint.

The Magnetic Club.

At a meeting held in the Western Union Building, Thursday evening, April 26, the Magnetic Club was organized and the following officers were elected: President, Charles P. Bruch; Vice-Presidents, William J. Dealy, Gardner Irving, William L. Ives and Lant S. Jones; Secretary, George F. Fagan; Treasurer, John Brant; Governing Committee, J. B. Taltavall, D. W. McAneeny, W. H. Baker, J. M. Moffatt, E. F. Howell, E. F. Cummings, C. Meyer, J. A. Brooks. The club is purely a social one, only men "connected with electrical pursuits" being eligible to membership. The above named gentlemen are all well known in telegraphic circles. Mr. Bruch is the popular secretary of the Telegraphers' Mutual Benefit Association. The club proposes to have four social gatherings each year.

Continuous Current Transformation.*

BY R. PERCY SELLON.

At a time when electrical engineers, both in England and America, are anxiously discussing what system of electrical distribution is to be looked to as likely to fulfill the requirements of supply of electricity over large areas, it may be well to inquire into the latent possibilities of a system which has hitherto received but an intermittent kind of attention, and even to a large extent with a sceptical incredulity—that of distribution by continuous-current transformers, or "motor-generators," as they are sometimes called.

The continuous-current transformer has really not yet been taken *au serieux*. Quite recently it was included among other possible systems of distribution, and figures adduced which showed it to compare unfavorably with the system of distribution by alternating currents, yet not so unfavorably as distribution by means of secondary batteries, or "battery transformers." In spite of this, the conflict of opinion lies between alternating currents and batteries, and continuous-current transformation is left out in the cold.

It is intended in these articles to glance at the subject—

First, in respect to relative merits and disadvantages when compared with other systems.

Second, to survey the past history of the continuous-current transformer, touching upon patents and publications relating to it up to date.

Third, to examine afresh its position from the practical standpoint, viz., that of initial cost and maintenance.

The past ten years, within which period all commercial electric lighting, under whatever system, has been condensed, have witnessed successively the following developments: First, series supply; second, multiple arc; third, series-multiple; fourth, secondary battery supply; fifth, alternate-current transformation. Until but a few years ago—one might almost say a few months—the first four systems absorbed all the attention of electrical engineers. Despite the earnest advocacy of "series" distribution by at least one well-known firm of manufacturers, electrical engineers have turned a deaf ear to this scheme as being likely to afford the true solution of the problem before them. "Multiple arc" has had, and in all cases where the area of supply is limited and compact is likely to have, a long and successful innings. A visit to any town of reasonable magnitude in the United States will readily convince one that under the above conditions "multiple arc" distribution—mainly on the three-wire system—answers sufficiently well both technically and financially. But, unfortunately, in this country, compact areas demanding electric light are not to be found. The "Britisher" does not build his houses so high nor adopt a good thing with the same avidity or unanimity as his American cousins. The conditions are, therefore, different. "Series-multiple," as a method of extended distribution for domestic purposes, requires no comment. Admittedly, therefore, there are left but three systems which may be regarded as able to fulfill the requirements of practical distribution over all areas. They are:

(I.) Distribution by secondary batteries alone, acting as transformers.

(II.) By alternate current transformation.

(III.) By direct current transformation.

For the moment these may be compared with reference to their relative values in the following directions:

(*a*) Adaptability to various demands: light, power and storage.

(*b*) Reliability of operation.

(*c*) Efficiency.

(*d*) Freedom from danger to life.

Dealing first, then, with the system of secondary batteries used as transformers. Secondary batteries can hardly yet be said to have been thoroughly put upon their trial for purposes of distribution. The installations at Colchester and the Vienna Opera have been the nearest approach to such a state of things, but the former, for well-known reasons, was short-lived, and the latter, though electrically successful in every way, only partially satisfies the conditions that must obtain in extended practice, inasmuch as the local centres of supply are few in number, and the charging current sensibly large compared with the demand from the batteries at each local centre. As regards the disposition of secondary batteries in any system of supply, it is evident that the scheme of distribution by their means from local centres must find favor with practical electrical engineers in preference to that of installing them upon each consumer's premises. There are two difficulties which must be coped with in any complete system of battery transformation: First (since the charging E. M. F. will, of course, be high), in order to preserve the discharging low tension supply from the full tension of the primary current in case of leakage, charging and discharging must not be carried on concurrently. This entails the use of two distinct sets of batteries. Second, the conditions of charge being those of high E. M. F. and small current, and of discharge the reverse of these, the batteries must be charged in sets placed in series with one another, and such sets thrown into parallel for the discharge. This entails a considerable number of relatively small-sized batteries, and a consequent arrangement of more or less complex automatic devices.

These considerations, however, involve no insuperable difficulty of any kind, but simply go towards a question of increased first cost arising out of multiplication of parts. In respect to adaptability equally to the demands of lighting and motive power, this system answers well, and in regard to reliability, absolute immunity from danger of extinction and freedom from personal risk of shocks, leaves nothing to be desired.

Distribution by alternate-current transformation is having it very much its own way just now. It is the idol of the hour. Ushered into existence only comparatively a few months ago with incredulity and even derision on many sides, the tide of electro-public opinion has turned with prodigious rapidity, and lifted it upon a rock of great, apparently, for the moment, of impregnable strength. The advantages of the system speak for themselves. The extreme simplicity of the apparatus for converting the initial high-tension primary current to one of low tension; the entire absence of moving or delicately organized parts requiring frequent attention; the perfect self-regulating properties of the transformers when placed in parallel; the high efficiency of conversion under certain conditions—all these constitute advantages which must at once recommend themselves to any practical electrical engineer.

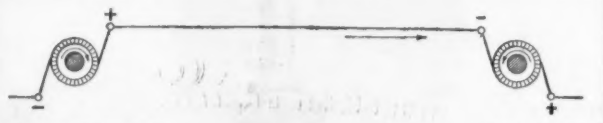
But this system lacks two important properties which are to be looked for in any ideal system of distribution:

(I.) The ability to store power.

(II.) Economical supply of motive power.

As regards the former, it is certain that, whether secondary batteries advocated as themselves the means of transformation, or as an adjunct to a low-tension system of supply obtained by other means, a system which admits of storage must, other things being equal, have unhesitating preference extended to it. That the application of motive power to a variety of purposes will promptly arise out of the ability to procure it must be carried home in the most convincing manner to any one who, as it has been the writer's good fortune to do recently, has seen the remarkable development in this direction attending the establishment of central stations in the United States. It is needless to say that this utilization of the plant during hours when it would otherwise be lying comparatively idle is a source of revenue of an important character, so much so, that, as the writer was informed upon the highest authority, it has frequently been the means of converting a loss on working to a substantial profit. Alternating-current motors cannot yet to be said to be an accomplished fact. That the demand for them will create and is in process of creating a supply there is no reason to doubt. Nevertheless, where the conditions of operation are those of rapidly varying load or speed (as must frequently be the case in practice), it is difficult to anticipate an economical compliance with the demand.

"But," it is urged in favor of this system, "despite its shortcomings in the above directions, it possesses this unique feature which neither battery transformers nor continuous-current transformers can claim, that by its means electricity can be conveyed direct on to each consumer's premises without the intermediary of local centres and their attendant outlay on land, buildings, distribution mains, and skilled attendance. It is therefore a system which can be put to work straight away, with a minimum of obstruction from Electric Lighting Acts, shilly-shallying Boards of Works, and vested-interest vestries." Granted. So long as the existing arrangement of overhead wires is permitted this argument possesses great force. But this blissful state of things must be short-lived. The time cannot be far distant when all conductors will have to be placed underground; and, as a matter of fact, it is more than probable that any electrical engineer contemplating the laying down of a system of alternate current distribution would at this moment of his own free will, provide for undergrounding all conductors. Under the latter conditions it requires no prophetic eye to foresee that the initial outlay, the danger of general leakage, the risk of shocks despite all precautions, and the cost of maintenance, arising from a ramified system of conductors conveying high-tension currents to the door of each consumer, will probably be held to more than balance the disadvantages attendant on the establishment of local centres.



Generating Dynamo. Motor Dynamo

MECHANICAL AND ELECTRICAL ANALOGIES

Assuming this, the balance of pro and con for the three systems becomes largely readjusted. The factor of local centres and distribution mains—both heavy items in initial outlay—becomes common to all. It resolves itself, then, into a question for consideration between the high efficiency of conversion, the relatively smaller area required for plant, and consequently smaller local centres, and to some extent diminished skilled attention, belonging to the alternate system, on the one hand, as against the benefits arising out of greater security from use of storage, income derivable from supply of motive power, and diminished risk of leakage and shock which pertains to continuous current supply, on the other.

The main objections raised against the continuous-current transformer resolve themselves into the following:

First, that it is a piece of moving mechanism; and this fact is not only fatal to its domestic adoption, but enables it to compare but ill with the stationary alternate converter.

Second, that it is a disproportionately high-priced article in contrast with the alternate converter, and will cost more to maintain.

Third, that its efficiency of conversion can never reach that of the latter.

Let us examine these objections:

First: Nobody will be so hardy as to dispute that our national education has not yet brought James or Abigail up to the point of being likely to view with any composure the diurnal lubrication or adjustment of a revolving dynamo wherein many hundred volts are urging on their wild career. There is no disguising this fact; it means local centres for distribution. But the opinion has already been expressed that, whatever the system employed, so long as high-tension currents—say, of 1,000 to 2,000 volts—are made use of, it will be expedient to distribute the low-tension supply from local centres; and, once given local centres, it ceases to be a matter of primary importance whether the transformers are in motion or stationary. A local centre for 2,500 lights, or 250 horse-power, obtained from continuous current transformers, need not mean more than a cellar 12 feet square; and, since the transformers are perfectly self-contained, the mechanical strains being all from within and not external, no elaborate precautions need be taken as to solidity of foundations or surrounding structure.

As to attendance, a single engineer would have no difficulty in attending to the requirements of such a sub station, even were the transformers built on the lines of our present dynamos—without any special precautions as to automatic lubrication and collection of current—and less attendance than this could hardly be provided under any system for any equivalent capacity in electrical energy supplied.

Secondly: As to the relative outlay requisite on the two different classes of transformer, it is obvious that if the continuous-current apparatus is built in accordance with the existing notions as to axial or peripheral speed holding in dynamo construction, its cost will be many times as high as that of the stationary alternate converter; but the very fact that in the former all the strains are from within must remove any scruple to run them at higher speeds than now obtained for dynamos, and thus bring the relative cost of the two classes of apparatus much more on to a par.

Obviously, this is only one of several difficulties to be met, and improvements to be effected, upon our present undefined ideas of continuous current transformers; but the point is that there is nothing inherently obstructive to their development in every direction to be desired, and the possibility of their development has only to be faced to be effected.

Thirdly: On the point of efficiency of the continuous-current transformer as an instrument, there is no difficulty at the present moment in obtaining a commercial efficiency of over 90 per cent. As to the relative mean efficiency of the two complete systems in practice, including generating dynamos, conductors and transformers, when working through the 24 hours on large variations of load from hour to hour, it is not a rash proposition to hazard that the continuous-current system would be found at the end of the day's work to have given a satisfactory account of itself.

More than one mind in this country is already busied with the development of the problem of which it has been attempted in these notes to point out some of the leading features, and at a period of rapid evolution of ideas like the present some practical outcome may be confidently looked for. In any case it is desirable to thresh out all that may be said on each side before settling down into a fixed groove.

In the next article it is proposed to refer to the more important patents and publications which have appeared relative to the continuous-current transformer, and finally to examine into the probable outlay required upon the supply of electricity to a given area under each of the four following systems:

(1.) Battery transformers.

(2.) Alternate-current transformers.

(3.) Continuous-current transformers.

(4.) Continuous-current transformers and batteries combined.

* London *Electrician*.

Practical Analogies Between Mechanical and Electrical Engineering.

To the Editor of The Electrical World:

SIR: I note in your issue of April 21 a criticism by Mr. H. F. Watts on my article on "Analogies Between Mechanical and Electrical Engineering," appearing in your valuable paper of April 7.

He insists that the supply pipe of one engine must be connected to the exhaust port of the other engine in order to make the engines coupled correspond with the case of a dynamo and motor. *Here is where his error lies.* If we consider the electric generator and motor, we will find that the current leaves one brush of the generator and enters one brush of the motor, and is conducted by an intermediate wire; this corresponds exactly with the supply pipe of one steam engine used as a compressor connected by a pipe with the supply pipe of a second engine used as a motor, as shown in Fig. 1 in my article of April 7. The instant we change the functions of the machines we practically change the function of the connections also; and by comparing the two mechanisms we will find, 1, that the power medium leaves the generator by an exit; 2, that the medium so generated enters the motors by an inlet; and 3, the outlet and inlet are connected for conducting the medium from the generator to the motor. This will be made more apparent if we designate the supply pipe of an engine with a (—) sign, because the air goes into the engine, and the outlet pipe (original supply pipe) of the inverted engine or compressor with a (+) sign because the air goes out of it, and mark the exhaust ports with correspondingly opposite signs. If we then compare the apparatus with a motor and generator coupled up as shown in the accompanying sketch we will find that there is no deviation in the arrangement nor inconsistency in the argument.

Mr. Watts makes the mistake in considering the supply pipe of one engine and the exhaust port of the other engine as the parts corresponding to the two connected brushes of the generator and motor. This is totally incorrect, and hence any assumption based upon it will be incorrect also. The only way to fairly consider the matter is to deal with the current as it is fed from the dynamo and into the motor, and compare that with the air passing from the compressor (through what would be a supply pipe if used as an engine) and into the (motor) engine (by its supply pipe).

If we were to take Mr. Watts' proposition we must of necessity supply the air to the supply pipe of the engine (motor), and then connect this supply pipe with the exhaust pipe of the engine (compressor) which would be entirely out of the question, for that would not be reversing the engine in any sense. I think that the points I make are well taken and will stand the closest criticism.

PHILADELPHIA, Pa. R. M. HUNTER.

Static Charge on Incandescent Wires.

To the Editor of The Electrical World:

SIR: Seeing in your issue of April 7 an account of the effect of static electricity on incandescent lamps, leads me to state a somewhat similiar experience of mine.

I have known wires in a building, running near a dry belt, to be so charged with electricity as to jump a spark over a space of three-quarters of an inch, from the positive to the negative pole of a cut-out. In this instance the negative wire of the system was slightly grounded.

It is a well known fact that an incandescent lamp may be so charged from a belt, that on approaching the bulb with the hand a severe shock will be experienced.

BROCKTON, Mass. G. W. P., JR.

The Electrolysis of Copper Sulphate in Standardizing Electrical Instruments.*

BY A. W. MEIKLE (THOMSON EXPERIMENTAL SCHOLAR).

Owing to the great increase in the use of electricity in recent years, and the consequent importance of having accurate measuring instruments, it is necessary that electricians should have some accurate means whereby they may have their standard instruments readily and cheaply checked from time to time. Much might be said for a national recognition of this fact by the establishment of a system of electrical standards, just as we now have national standards of length, weight, etc., but such a subject is beyond the province of this paper, in which I propose to give a description of the electrolysis of copper

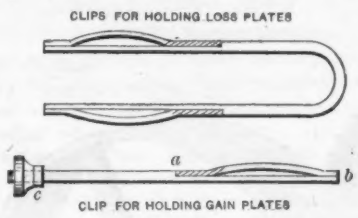


FIG. 1.

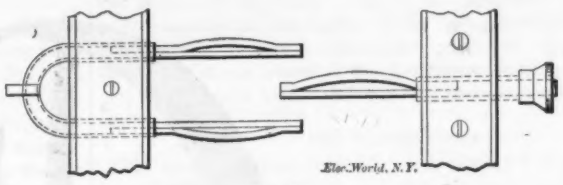


FIG. 2.

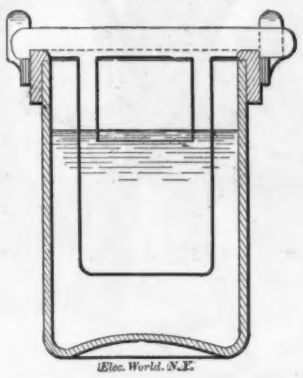


FIG. 3.

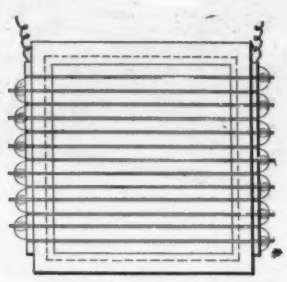


FIG. 4 AND 5.

CURRENT MEASUREMENT BY ELECTROLYSIS OF COPPER SULPHATE.

sulphate, which has been employed for standardizing purposes in the Physical Laboratory of Glasgow University for the last two years with the most satisfactory results.

A paper communicated by Mr. Thomas Gray to the *Philosophical Magazine* for November, 1886, dealt with the question of the reliableness of copper electrolysis as compared with silver. The conclusion drawn from the investigation described in that paper was, that while silver in the hands of a trained experimenter left nothing to be desired in point of accuracy, still it is open to the objection that it is very costly where large currents are used, and requires great care in making the experiments. Copper, on the other hand, has the advantage of simplicity in manipulation, and where attention is given to a few necessary precautions great accuracy can be obtained. As an example of the difficulties in the use of silver I may mention that the deposit, which is always crystalline in form, requires careful handling in order to prevent loss in drying or weighing, and in order to get it thoroughly adherent to the plate the area of the cathode or gain plate should never be less than 200 or more than 400 sq. cms. per ampère. With copper the deposit for areas exceeding 20 sq. cms. per ampère is thoroughly adherent to the plate, of which, indeed, it forms an integral part. Thus in making an electrolysis of copper sulphate for 100 ampères, a current density of 1 ampère to 50 sq. cms. would give excellent results, and the total area of gain plates would only be 5,000 sq. cms., while were silver used the area would require to be from 20,000 to 30,000 sq. cms. One disadvantage which copper has is its readiness to oxidize when exposed to the air, more especially when being taken out of the sulphate of copper solution, but if the mode of cleaning and drying the plates, both before and after electrolytic action, which is described in this paper, be employed, this difficulty is easily overcome. I have kept plates for a week after being treated in this manner without being able to observe any change of weight as indicated by a chemical balance, which is sensitive to $\frac{1}{10000}$ of a gramme.

Another point, which has to be taken into account, is the fact that the plates lose weight in the solution at a rate varying with the area they expose to the action of the acid which is contained in all electrolytic solutions of sulphate of copper capable of giving reliable results. This question was gone into very fully by Mr. Gray about two years ago, and the results are given in his paper on electrolysis which is referred to above. It has again been gone into when making some experiments on the effect of temperature on the loss of weight of the plates in the solution. The results of these experiments, which were made by passing the current through ten cells in series, each of which had a different area of plate, is to confirm the experiments made by Mr. Gray, and to show that the amount of variation from the true electro-chemical equivalent of copper due to differences of current density can be allowed for with great accuracy. Before describing particularly the results of these experiments, it may be well to refer briefly to the apparatus used.

Electrolytic Cells.—The electrolytic cell found most convenient for small currents consists of a round glass jar nearly filled with sulphate of copper solution, into which three vertical plates with their surfaces parallel and about 15 mm. apart are held by means of rigid platinoid clips. The two outside clips are joined together and the plates held in them are the anodes or loss plates, Fig. 1. Two loss plates are always put into each cell, one on each side of the gain plate, so that the gain plate may receive a uniform deposit on each side. The centre clip which is well insulated from the two others holds the cathode or gain plate. The clips for holding the gain plates are formed of straight pieces of No. 6 platinoid wire about six inches long, a portion of which, about four inches long, is filed flat, and on to this another piece of platinoid, bent so as to form a powerful spring is soldered at *a*, so that the end of the pieces form a firm contact at *b*. Fig. 1. A binding screw for fixing on the electrode is screwed on to the other end at *c*. Several of the clips so formed are firmly clamped on to a rectangular wooden frame by screwing a strip of wood down on the top of them, the portion of the clip between the wood being well insulated by being covered by a piece of thick india-rubber tube.

The clips for holding the loss plates are formed in the same manner as the gain plates, but are made in pairs by bending a piece of No. 6 platinoid wire into the shape of a U, with about three centimetres between its ends, and then soldering on the springs as already described. These clips are insulated and fixed on to the frame on the opposite side from the single clips, so that the ends of the latter come just between the two ends of the former, as shown in Fig. 2. A flexible-covered copper wire, of convenient length to enable the cells to be joined in series if desired, is permanently soldered on to the bend of the double clips. This mode of placing several sets of clips on a wooden stand is found very convenient, as the plates can readily be adjusted in their position or taken out without disturbing any of the other arrangements. This form of clip suits very well for currents up to about 15 ampères, by joining the cells in series or parallel, as may be necessary. In using electrolysis for small currents up to 2 ampères, it is advisable to use two or even three cells in series, as with small deposits a check is thus obtained on the weighing or any defect in an individual cell. With currents of from 3 to 15 ampères I prefer still to use this form of clip and a sufficient number of cells in parallel, each having gain plates of about 130 sq. cms. in area, so that the plates, owing to their comparative lightness may be weighed on the chemical balance—the additional number of weighings being more than compensated for by the additional accuracy obtained.

For currents such as are used in standardizing a deca or hecto-ampère balance, owing to the large amount of copper deposited, such delicate weighing is not necessary, and a balance sensitive to about 2 milligrammes may be used; but even were an error of 5 milligrammes made in weighing the plates of an electrolysis for 50 ampères continued for one hour the error would only amount to about $\frac{1}{120}$ per cent. For high currents such as these, a large earthenware cell is used, which is shown in Figs. 3 and 4. A wooden frame is fitted on to the top of this cell, and on two opposite sides of this frame, and well insulated from each other, two copper bars are screwed, one having 10 and the other 11 spring contact clips of the form shown in Fig. 5. The plates of this cell are made of sheets of copper, each of which has a rigid strip of copper soldered to its top edge and projecting about two inches on each side of the plate. On putting the plates into the cell, one end of this strip fits into a clip and the other rests in a vulcanite notch on the other side of the cell. Each of the plates when in position exposes a surface of 1,100 sq. cms. to electrolytic action, so by putting in the proper number of plates the cell can be used for currents up to 200 ampères. The plates and clips are so arranged that one gain plate comes between two loss plates, and the latter always exceed the former in number by one. As the plates, when all are put in, are very close together, two glass tubes bent so as to form Us, and long enough to reach to the bottom of the cell, are hung over each loss plate to prevent any danger of the plates touching. Two flexible electrodes suitable for dipping into mercury cups are attached to the bars carrying the clips.

The Solution for the Electrolytic Cells.—The solution used is made by dissolving commercial copper sulphate in pure water as it comes from the Glasgow Corporation's water pipes until a density of from 1.15 to 1.18 is obtained, and then adding 1 per cent. of free sulphuric acid. In all the experiments mentioned in this paper the solution used has been of a uniform density of 1.175, but it has been found that a variation in density from 1.1 to 2 makes no difference in the nature or quantity of the deposit. With solutions made up as described perfectly accordant results have invariably been obtained. The solution should not be used too often as the acid is after a time exhausted by action with the plates, and it has been found from experience that unless the solution is decidedly acid the plates are oxidized in the solution and very irregular results are obtained which are quite valueless for accurate standardizing.

Preparation of Plates.—The gain plates used are made from ordinary high conductivity sheet copper about $\frac{3}{10}$ths of a millimetre in thickness. For the smaller cells they are cut in the shape shown in Fig. 6, as this form of plate, owing to the flexible tongue, is very easy to adjust in its position, and when in use the whole plate is immersed in the solution, except the narrow tongue necessary to hold the plate between the contact clips, thus leaving a very small area exposed to any possible oxidation by the atmosphere. This form of plate has also the advantage that the area exposed to electrolytic action can be got at once, or may be permanently stamped upon the tongue, and the proper equivalent for the current density can be taken without having to measure the area covered by the deposit. The edges of the plate are all smoothed, and the corners rounded off, as the deposit is apt to form on any rough edges, especially if a high current density is being used, or if the current is being run for a long time. When this has taken place the plates, owing to the roughness of the surface, are not so readily dried, and the risk of oxidation is increased, as is also the risk of losing part of the deposit should the plate accidentally strike against any object. The surface of the plates is burnished with fine glass paper until perfectly bright and smooth, then rubbed with a piece of clean cloth, and finally wiped gently with a piece of silk to remove any shreds, after which they are ready for weighing. The method which has been found most convenient, however, is to place a sheet of No. 1 glass paper on a wooden roller and spin it in a turning lathe, holding the plate against it by a pad. When the plates have been burnished by this method, the sand paper, which is only held on the roller by two springs, is removed, and a piece of rough cloth put on instead. On this cloth the plates receive a final polish to remove grains of sand, then wiped with a piece of silk as in the first method, after which they are ready for weighing. Care should be taken never to touch with the fingers the portion of the plate intended for immersion in the cell, as by so doing the surface is spoiled for a deposit, and the mark of the finger is seen distinctly after the electrolytic action.

Loss plates are also made from high conductivity copper, but from a thicker sheet, so that they may last for some time. No great trouble need be taken with them, except to see that they are not put into the liquid when badly oxidized, in which case the free acid in the solution unites with the oxide on the plate, and the solution suffers in consequence, as already explained. For this reason, too, the loss plates should never be left in the solution when not in use, but should be taken out and placed in water with a few drops of H_2SO_4 added, or, if they are not likely to be required again for some time, they should be dried and put away.

Size of Plates.—Loss plates should never have an area of less than 40 sq. cms. per ampère. If the area is much less than that, the resistance of the cell becomes high and variable owing to the formation of copper oxide on the plate, and if it be made very small, gas is given off at its surface, making it impossible to keep the current steady, and giving a result of no value for accurate standardizing. The gain plates should never expose a surface of less than 20 sq. cms. per ampère. When too high a current density is used, the deposit is not so adherent to the plate, and a portion may be lost in washing and drying. It is always best to use an area of from 50 to 100 sq. cms. per ampère, using the larger area for currents which are intended to run for some time. By doing so any little roughness round the edges is avoided, and in consequence the plates are easier to dry.

As already mentioned at the beginning of the paper, the amount of copper deposited by a given current varies with the area of the plate exposed to the corrosive influence of the free acid in the solution of copper sulphate.

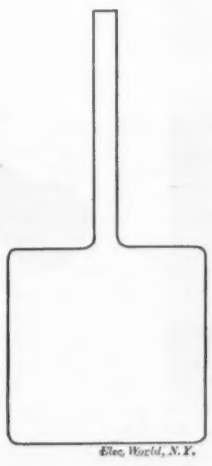


FIG. 6.

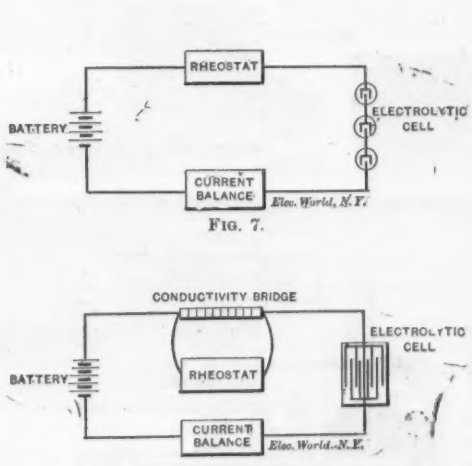


FIG. 7. FIG. 9.

FIG. 8.

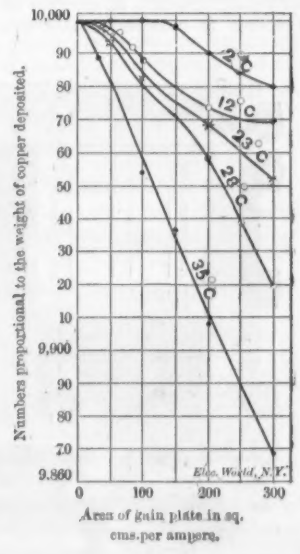


FIG. 10.

CURRENT MEASUREMENT BY ELECTROLYSIS OF COPPER SULPHATE.

*Paper read before the Physical Society of Glasgow University January 27th.

This variation is not the same as it would be were no current running; in reality it is less, from which it would seem that the current exercised some protecting power. This subject has been very fully investigated in the Physical Laboratory, as also the effect of temperature on the rate of loss, and the results of the experiments are shown in the curves, Fig. 7, and the two tables of numbers which I shall speak of presently.

The experiments were made with ten cells in series, all caretully insulated from each other, and each cell having a different area of gain plate, the extreme range being from about 30 to 500 sq. cms. per ampere. The solution used in all cases was 1.17 in density with 1 per cent of H_2SO added. From former experiments described in Mr. Gray's paper on electrolysis before mentioned, no difference could be observed in the amount or appearance of deposits from solutions containing percentages of acid varying from ½ per cent. to 5 per cent. at a temperature of about 12 degrees C.. but owing to the very rapid consumption of the free acid in the solution at the high temperatures, fresh solution was used each time.

The curves show the results obtained for different areas of cathode or gain plate, and each curve is for a different temperature between 2 degrees C. and 35 degrees C. It will be observed that they all converge rapidly toward the point of crossing, which shows that the same deposit would be had at all temperatures were it only possible to use a small enough area of gain plate. The curves were produced to cross the line of ordinates, and the point of crossing was taken as 10,000 and the other points reduced to correspond so as to render percentage corrections easy for different current densities. The ordinates are therefore numbers proportional to the weight of copper deposited in grammes, while the abscissæ are areas of gain plate in square centimetres per ampère.

A glance at the curves will show how important the question of temperature becomes at the high points. In countries where 28 degrees and 35 degrees C, were normal temperatures a very careful allowance would require to be made for any variation. Table No. 1 gives the numbers from which the second tables of curves is taken, and table No. 2 gives the corrected electro-chemical equivalents as calculated from these numbers for different current densities from 1 ampère to 50 sq. cms. up to 1 ampère to 300 sq. cms.

TABLE I.

Area of cathode in square centimetres per ampère of current.	Temperature, 2° C.	Temperature, 12° C.	Temperature, 23° C.	Temperature, 28° C.	Temperature, 35° C.
50	10000	9996.4	9995	9993.5	9980.5
100	10000	9987	9983	9979.5	9958
150	9998	9979,5	9974	9969.6	9935
200	9990	9978	9966.6	9957.5	9912
250	9984	9970	9959,5	9939,3	9890
300	9980	9968,5	9952	9920	9868.5
400	.....	9961	.....	.....	.....
500	.....	9949	.....	.....	.....

TABLE II.

Area of cathode in square centimetres per ampère of current.	Temperature, 2° C.	Temperature, 12° C.	Temperature, 23° C.	Temperature, 28° C.	Temperature, 35° C.
50.....	.0003288	.0003287	.0003286	.0003286	.0003282
100.....	.0003288	.0003284	.0003283	.0003281	.0003274
150.....	.0003287	.0003281	.0003280	.0003278	.0003267
200.....	.0003285	.0003279	.0003277	.0003274	.0003259
250.....	.0003283	.0003278	.0003275	.0003268	.0003252
300.....	.0003282	.0003278	.0003272	.0003262	.0003245

Standardizing Arrangements.—The arrangements for standardizing consist, as shown in the diagrams, in joining in series a constant battery, the instrument to be standardized, the electrolytic cells and a variable resistance. Care should always be taken to join the instrument directly on to the electrolytic cells, and have that portion of the circuit well insulated so as to be sure that the instrument is recording the exact amount of current which is going through the cells.

The simplest form of arrangement is shown in Fig. 8, and is suitable for currents up to 10 ampères. The variable resistance used in this case is one of Sir William Thomson's rheostats. For currents up to 1 ampère a high resistance rheostat of platinoid wire is used, and for currents above that point a large rheostat of stranded copper wire—the potential of the battery being first adjusted to suit the special case. With large currents beyond the carrying power of any rheostat a conductivity bridge is put in circuit for the purpose of varying the current. This bridge consists of a number of platinoid U's of sufficient length not to heat much with any current which the potential of the battery can send through them. By dipping the two ends of these U's in two parallel mercury troughs, any desired conductivity can be put into the circuit. Fig. 9 shows two of the large bridges, one of which is standing in the mercury troughs, while the other is standing on the insulated sides. The large bridges are kept apart by wooden distance pieces, as shown in the figure, while the small ones are supported on strips of wood through their whole length, and are fitted with thick copper terminal piecees. The copper rheostat before mentioned is joined in parallel to this bridge, and the whole arrangement, as shown in Fig. 10, simply takes the place of the rheostat in the former arrangement. We have found this last arrangement very useful for standardizing instruments, as, with the battery power at our disposal, any current up to 500 ampères can be had by continuous steps. The apparatus being arranged as stated above, trial plates of the same area as the gain plates to be used are put into the electrolytic cell, and the current is adjusted to the required reading on the instrument. The circuit is then broken, the trial plates are replaced by the cleaned and weighed gain plates, and current is again made—the exact second being noted on an accurate timekeeper. The instrument should be found very nearly to record the desired reading, and should at once be adjusted by turning the rheostat, and by that means be kept steady during the experiment. Any error arising from the current not being at the proper strength on starting is very small. As a rule the current, when previously adjusted as above, is, practically speaking, exactly correct when made for the standardizing, but should it chance to be even so much as 5 per cent. wrong, an amount which, with the precautions taken, is entirely out of the question, it can easily be set right in at most 10 seconds, with apparatus such as has been described, and the whole error on an experiment lasting for one hour would only be about $\frac{1}{110}$ per cent. The current should be run until the amount of the deposit will be such that any possible error in weighing or in starting or stopping the current is, practically speaking, eliminated. In breaking the current the exact second is again noted, and the plates quickly removed from the clips, and placed in a glass vessel containing pure water with a few drops of H_2SO_4 added to prevent oxidation. From this they are taken one at a time, dipped in pure water, then dried and weighed, as before described in the process of cleaning with silver sand. The jaws of the clip are always opened before putting in or taking out the plates, so that there will be no error due to loss of weight by the friction of the plate with the spring contacts. The zero of the instrument is always carefully noted before and after the experiment.

New Automatic Cut-Off Engine for Electric Lighting.

To meet the demands of close regulation essential in engines driving dynamos, the Erie City Iron Works, of Erie, Pa., have recently brought out an automatic cut-off engine which, it is claimed, maintains a practically constant speed with change in either load or steam pressure.

The engine, which is shown in perspective in the engraving, Fig. 1, has a bed of the Porter type, and is designed for both strength and symmetry.

The cylinder and the steam chest are cast together, and Fig. 2 shows a horizontal section through them and the stuffing boxes, as well as a part of the bed, and the piston valve. The steam ports are very short, and the passages for exhaust steam are equal to the area of the exhaust pipe. The steam chest being in the centre of the cylinder, the exhaust takes place at each end, making a quick exit for the waste steam. The steam ports are covered by removable plates, allowing easy access for inspection of the ports, without removing the valve, or either front or back steam chest covers. As the stuffing box for the valve stem needs to be packed only for exhaust steam, very little friction is produced at this place.

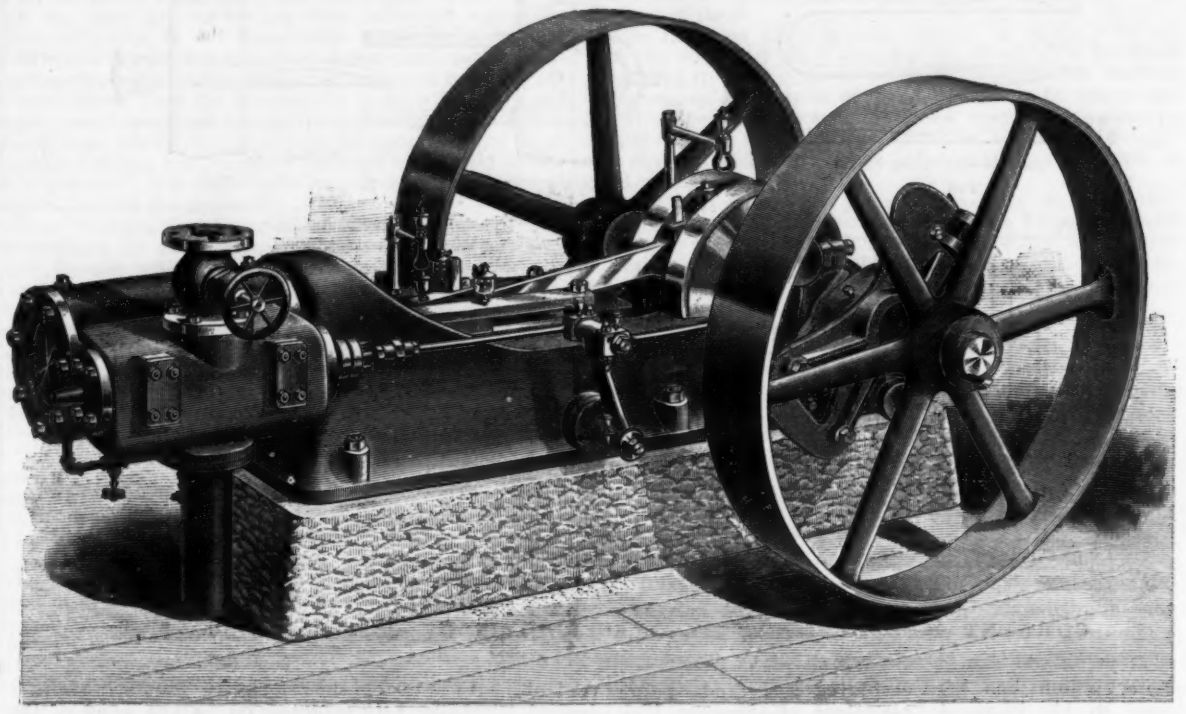
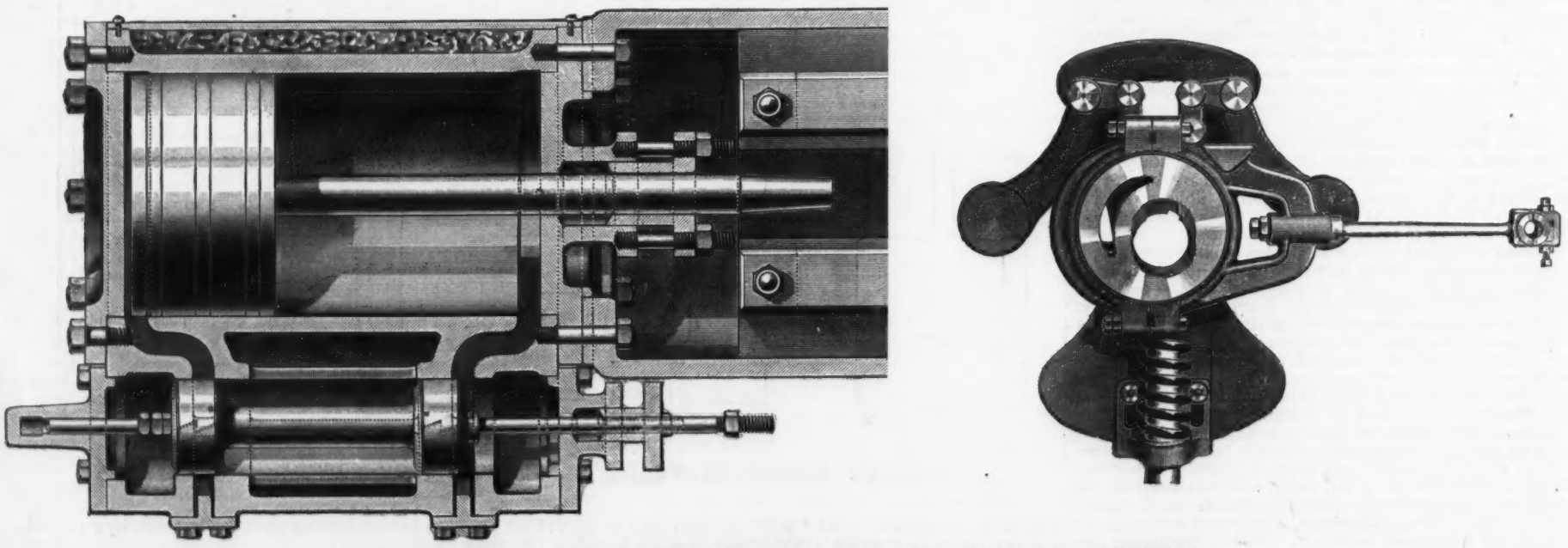


FIG. 1.—NEW AUTOMATIC ENGINE FOR ELECTRIC LIGHTING.

The piston valve is of simple construction, consisting merely of a thin ring of proper width, and made by a special method, so that when it is in position in the steam chest it is a perfect fit. Being also a sprung ring, it takes up its own wear, and is at all times tight. The valve ring is completely balanced, as it is round, and live steam is admitted only between the two inside shoulders of the valve, which, being of equal area, balance each other. The ring has a small hole drilled in the port side, permitting live steam to enter only when the valve is admitting steam to the cylinder. This is done to counteract the tendency of the valve to close up when it is uncovered by the steam port; live steam enters the small hole and acts on the inside of the valve, pressing it outward, counteracting any outside pressure.



FIGS. 2 AND 3.—NEW AUTOMATIC ENGINE FOR ELECTRIC LIGHTING.

The governor employed in connection with the engine is shown in detail in Fig. 3. As will be seen it is a shaft governor and is a decided departure from the usual style. The action of the weighted arms which regulate the position of the eccentric is counteracted by a spring, the ten-

sion of which can be adjusted. The weighted arms, being perfectly free and having a long leverage, act powerfully on the eccentric, and as there is very little friction the response to change of load is almost instantaneous. The question of lubrication has also been well considered and means have been provided for continuous oiling of all moving parts.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, April 30, 1888.

The Sprague Company.

Owing to the growth of their business, the Sprague Electric Railway & Motor Company find themselves cramped in their present quarters at 16 and 18 Broad street, and are now moving into much larger offices on the fifth floor. Mr. Harding tells me that the company have sold within the past sixty days one-sixth as many motors as they have sold since the company was started. Mr. C. M. Barclay, one of their active western agents, was in town last week, and reported closing two large street railway and power contracts at Davenport, Ia., and Lafayette, Ind.

The Police Signal System.

Dr. F. B. Herzog, the successful bidder for the privilege of erecting the police signal system, visited the Police Commissioners Friday last and submitted a modified contract. He proposes to erect 400 lamp-post boxes below 42d street, larger than those in the 19th Precinct, and to deliver them to the Commissioners complete and in full working order, together with station-house plants, for $100,000. He will make all necessary repairs on such portions as are free from patent rights not controlled by him, for a profit of 12½ per cent. over cost. The new feature in the modified contract is in the following words: To install, subject to the contract, a general system of sub-stations, by putting boxes in such private residences, stores, offices, institutions or any other buildings as may be requested by any tax-payer or citizen, subject to the consent and control of the Board of Police, the installation price never to exceed 40 per cent. above the cost of the same, the subscribers to pay for the boxes, and in addition thereto a rental or royalty of $9 per annum for the use of the same. It is further agreed that there shall be paid into the Police Pension fund, $3 annually, or one-third of the amount received from every building in which a signal box may be installed.

Belting for Dynamos.

Chas. A. Schieren & Co. report sales of their leather link belt recently to the following concerns for use on dynamos: Lima Electric Light and Power Company, Lima, O.; Chester Electric Light Company, Chester, Pa.; Edison United Manufacturing Company, U. S. Navy Yard, Brooklyn, N. Y.; Bay State Shoe and Leather Company, Kings County Penitentiary, Flatbush, L. I.

New Subway Work.

The work of the Board of Electrical Control for 1888 has been planned, and will be started actively the first week in May. It embraces the unfinished work of last year and the completion as far as possible of the intermediate sections between the down-town and up-town districts. The work authorized, exclusive of Edison ducts in subway trenches, is 626,235 feet. This is about 118 miles, or nearly 50 per cent. of the total length of the duct laid during 1887. It covers the completion of the trunk line on Sixth avenue and South Fifth avenue, connecting the two districts; the completion of the Broadway lines up to Central Park, the sections on Eighth, Seventh and Madison avenues, and the two cross-town lines, besides a few scattering pieces and the Edison work. This will occupy from three to four months. The Construction Company has recommended a line of new work and it is now being considered by the Subway Commissioners. Its extent is 615,000 feet of single duct. About 5,000 men will be put to work next month in Sixth avenue, South Fifth avenue, Broadway, Eighth avenue, Frankfort street, Lexington avenue, Twenty-third street and Spring street. The sections will be prosecuted simultaneously.

The National Conduit Company.

Mr. J. P. McQuade, of the National Conduit Company, has just returned after an extended trip West. At Kansas City, he tells me, he found quite a difference of opinion existing on the conduit question, arising out of a conflict of authority between the mayor and alderman as to putting a certain system underground. The question is still an open one, and at the first meeting of the new board, Mr. McQuade's company, or its representative, will apply for a franchise, and they think it will be granted.

A Steam Yacht Plant.

Mr. John W. Slater, of Providence, owner of the steam yacht "Sagamore," is to have a model Edison plant, which is being installed by Buehler & Bateman. There will be 75 lamps of 16 c. p., together with a 30-light accumulator plant. The contractors flatter themselves that when they get through this will be the best marine plant that has yet been installed.

Tucker Electric Manufacturing Company.

This company are hard at work fitting up the fine residence of Mr. Archibald Rogers, of Hyde Park, near Poughkeepsie, with bells, annunciators, burglar alarms and gas lighting apparatus. They inform me this will be the most elaborate system of bell work yet introduced in this country into a private residence. The alarm service will take from 25 to 30 sections.

Sound Steamers.

Very few of our Sound steamers are now to be found without an electric light plant. One of the latest fitted up is the "C. H. Northam," of New Haven, which has an installation of between 400 and 500 lamps of 16 c. p. of the United States Electric Light Company's system. When the lights were turned on a week or two ago the owners gave a grand festival on board. The installation includes about 15,000 feet of special Grimshaw white core fireproof wire, which is said to be peculiarly fitted for installations afloat. On board this boat also Messrs. Edwards & Co. have just placed their latest improved annunciator with several hundred drops. A feature in this annunciator is that even the most violent movement of the boat will not cause the drops to fall, as they are specially balanced so as to avoid this trouble. The "Mary Powell" is also to be fitted up with the United States system, the installation corresponding practically to that of the "C. H. Northam."

Freehold, N. J.

Mr. F. H. Chinnock has taken the contract for 600 Edison lights for Freehold, N. J., and the plant will be put in at once.

Straight Line Engines.

Messrs. Williams & Potter, of 2 West Fourteenth street, have taken the general agency for the Straight Line Engine. They have recently received orders from the Julien Traction Company for two engines; from Levi P. Morton for one to run his Sawyer-Man plant; from Jas. Edwards for one to run the Edison plant in his new baths, and from Mr. A. Rogers one for his Edison plant at Hyde Park. Mr. F. H. Hayward has taken the selling agency for this engine, under the supervision of the above named firm. It may be remembered that Mr. Hayward established a Western branch of the Armington-Sims engine some two and a half years ago. He has considerable experience in the engine field.

Self Winding Clocks.

The American Manufacturing and Supply Company, Limited, 10 and 12 Dey street, have just issued a very neat and tasteful little pamphlet, the object of which is to spread a more general knowledge concerning the merits of their self-winding clocks. With this end in view, a very simple and clear explanation is given of the method of operation together with several illustrations, and this is supplemented by a large number of testimonials from those who have been using the clocks.

Callender Cables and Wires.

The Callender Insulating and Waterproofing Company has just issued a little pamphlet, in neat shape, containing an illustration of its conduits for arc and incandescent lighting, and giving a number of testimonials as to efficiency and durability of its cables after two or three years of use. These communications come from the Edison Company of New Brunswick, the Edison Company of Cincinnati, the Edison Company of Detroit, the Edison Company of Columbus, O., the California Electric Light Company of San Francisco, using the Brush system, and the Mather Company of Hartford, Conn. The Callender Company are experiencing a very active demand for their cables, and their factory is in full blast.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
48 Congress Street, Boston, April 30, 1888.

Personals.

Mr. C. A. Coffin, the vice-president of the Thomson-Houston Electric Company, has returned to his home in this city after a pleasant sojourn of two weeks with his family at Old Point Comfort, Va.

Mr. Edward S. Perot, general manager of the National Conduit Manufacturing Company of New York, favored this office with a visit last week.

Mr. Gardiner C. Sims, of the Armington & Sims Engine Company, Providence, R. I., has just returned from Aiken, S. C., where he had been on a "flying visit" to his old friend, Mr. A. F. Upton, who, together with his two daughters, has been sojourning in that city for several weeks. Mr. Sims reports that a great improvement has taken place in the health of Mr. Upton, and that the latter gentleman contemplates returning to his home and business in Boston about the middle of May, but his family will remain in the South for some time to come.

Mr. H. B. Frost, of New Haven, has also been for the past few weeks recuperating his health and strength at Aiken, S. C., and has so far recovered from the stroke of paralysis received by him in February last while in Florida that he was making arrangements last week for a visit to, and a short stay in, Washington, D. C.

Telephone Gossip.

In the financial column of the Boston *Herald* appears the following: Avaricious stockholders have formulated a (to them) profitable scheme for issuing long distance rights, in the form of 6 per cent. bonds at 50 cents on the dollar. To the credit of the management be it said that it denies all reports regarding such rights. The petition for the reopening of the Drawbaugh telephone case has been forwarded to Washington, and the motion will be made Monday, April 30. The Drawbaugh people hope for a decision in their favor, as Justice Lamar can make the court stand 4 to 3 for a reopening. Decision will be given before May 14, when the court adjourns.

The Boston *Globe*—same date—thus comments on the same subject: Officials are considering their long distance plans, and the talk of well-informed telephone men is a scheme of "rights" to Bell Telephone stockholders to subscribe annually at 50 for the next five years to Long Distance Telephone Company bonds, guaranteed by Bell Telephone Company and convertible into Long Distance Telephone Company stock, which stock, it is claimed, will be worth $150 per share. How much money per annum will be needed has now to be determined, but it may be said that the cost of long distance telephone construction is not far from $3,000 per mile.

Electrical and Scientific Instruments.

The electrical fraternity are beginning to learn and to fully appreciate the fact that there are manufacturing establishments in the country where the finest grades of electrical and scientific instruments are made; and it has been proven that American made instruments of the present day manufactured by A. L. Russell, of Boston; Western Electric Company, of Chicago; by Mr. Edward Weston; by Queen & Co., of Philadelphia; the Electrical Manufacturing Company, of Greenbush, N. Y., and others, are equal, in every point, to those of foreign manufacture.

Mr. Russell's factory at 109 Court street, Boston, was in years gone by the electrical establishment of Mr. Charles Williams, Jr. A visit to this factory recently presented to my notice a large array of scientific instruments for electric light purposes and electrical measurements, such as rheostats, galvanometers and testing generators. Among the above-named instruments were three beautiful and valuable sets which merit special mention. One was a powerful electric light testing generator, which rings a bell through a resistance of 16,000 ohms. Another was a combination set, comprising rheostat, galvanometer, key and bridge, which has a measuring capacity of $\frac{1}{10}$ of an ohm to 45,000 ohms. This is considered a compact and very useful instrument. Still another was a large standard set, composed of rheostat, Thomson mirror galvanometer, key and bridge. The latter is a set of instruments extensively used by the electric light manufacturing companies and manufacturers of electrical supplies and wire.

An Interesting Lecture.

Mr. A. L. Rohrer, of the Thomson-Houston Electric Company, gave a lecture at Association Hall, Lynn, Mass., on Wednesday evening, April 18. The subject of the lecture was "Electricity," and was treated upon by Mr. Rohrer in a most accurate and comprehensive manner, many of the details being explained by experiments with electrical and electric-lighting apparatus. The large audience were an intelligent body of people, and the lecture was highly appreciated, as evinced by the frequent applause.

A Large High Speed Engine.

The Armington & Sims Engine Company, of Providence, R. I., have shipped from their works, to the new Edison central station in Chicago, one of their 200 h. p. special engines. It is a model of fine workmanship.

A New Series Lamp.

The Schaefer Electric Manufacturing Company, of Cambridgeport, Mass., has discarded its machinery for the construction of dynamos, and increased its facilities for making incandescent lamps and incandescent lighting apparatus. Among the new additions to the product of the lamp department of the Schaefer Company is a series incandescent lamp, which in its construction, and the peculiar merits it possesses, will certainly attract a good deal of attention from local electric light companies as soon as it is placed in the market.

Electricity for Revere, Mass.

The selectmen of Revere gave a hearing in the town hall a few evenings ago to the Lynn & Boston Railroad Company for permission to erect a line of poles on Ocean avenue, Crescent Beach. No one appeared in remonstrance, and the subject was taken under consideration. Rails are now being laid by this company through Ocean avenue to Oak Island, and it is contemplated to run cars by electricity, provided the privilege to erect poles along the route is granted by the Selectmen. Two electric light companies are now endeavoring to secure the right to furnish light for house and street lighting for Winthrop and Revere. One is the Edison Municipal Electric Light Company and the other is the North Shore Electric Light Company, using the Thomson-Houston system. The latter company has in view a location for for its plant near the Eastern Raiload station in Revere. A public hearing will be given the two companies.

Electric Motors for New Bedford, Mass.

The New Bedford Gas and Electric Company have purchased, through H. C. Spaulding, agent of the Thomson-Houston Company, a power plant, consisting of one 50 h. p. generator and motors from 1½ to 7½ h. p.

New Business of Thomson-Houston Electric Company.

The Thomson-Houston Electric Company has received very flattering reports from Owego, N. Y., where its agents have installed an incandescent plant, using the company's four-wire compensator system. This is a long distance incandescent system which enables lighting to be done at a far greater distance from the station than the ordinary low tension system, and yet uses lamps of the same voltage. The area covered at Owego is about 6,000 feet radius low potential system. Every one who has seen it speaks in the highest terms of its successful operation. The following summary is a showing of the company's new business elsewhere during the months of March and April not previously mentioned: Cambridge, Mass., 30 arcs; Smith Lumber Company, Kalkaska, Mich., 30 arcs; Oxford, North Carolina, 50 arcs; Westboro, Mass., 20 arcs; Narragansett Pier, 2,000 alternating, 50 arcs; Mobile, Ala., 35 arcs; Paterson, N. J., 150 arcs; Atlantic City, N. J., 50 arcs; Manitou Springs, Colo., 400 incandescents.

Resignation of Superintendent Hamblin.

Mr. H. W. Hamblin, who has been the superintendent of the Pawtucket (R. I.) Electric Light Station since the starting up of that successful enterprise, has tendered his resignation to the president of the company, to accept a more important position at Portland, Me.

Two Electrical Inventors in New Positions.

Messrs. Hermann Lemp and Merle J. Wightman, prominent electrical experts and inventors, both of whom have been identified with the Schuyler Electric Company, have accepted situations at the Thomson-Houston Electric Company's factory, Lynn, Mass.

Non-Corrosive Steam Gauges.

The Starr Brass Manufacturing Company of Boston have added to their establishment during the year a department for the manufacture of steam, water and vacuum guages and other instruments incident to the use of steam, air or water. It would seem that the company has solved the problem of making steam gauges perfectly non-corrosive, by substituting a hard nickel alloy in place of iron or steel heretofore used in the movements of these instruments; that is, all the working parts, such as pinion and segment shafts, are made entirely of this metal, and thus preventing these parts from corroding. The tensile strength of this alloy is precisely the same as steel, but the metal is susceptible of a higher finish, a very essential point indeed, when it is conceded that the presence of the least amount of friction is detrimental to the accuracy of these instruments. There is a growing demand for these instruments, and the company at present is full of orders.

Reducing Valves for Steam Plants.

This apparatus is one of the most popular and saleable of the varied product of the Mason Regulator Company's factory in Boston, Mass. Many of these valves are in use among the electric lighting stations throughout the country and the demand is steadily increasing. The company reports having been behind its orders during the winter and has already caught up and commenced manufacturing stock for next fall. The Mason Company is also making a new diaphragm valve for use in connection with

automatic heat regulating appliances. It was recently put on the market, and is already finding much favor among electricians.

An Active and "Go-ahead" Company.

The Electric Gas Lighting Company of Boston has scored a success with its single magnet automatic gas burner. Manager Burnham says the sales of this popular burner have exceeded the company's most sanguine expectations, and that, although great efforts have been made to talk it down, there has been a constantly increasing demand for it. Mr. Burnham says further, that his company is rushed with orders from all parts of the country for its specialties, and is compelled to run its factory at the full capacity day and night. Among goods in special demand, besides electric gas lighting apparatus, may be mentioned the Tirrell gravity drop annunciators and burglar alarms, Victor iron back and standard bells, and its full line of push buttons and electric bell pulls. This company is continually receiving praise for the quality and finish of all its manufactures.

The New Electrical Supply House.

When Messrs. F. E. Pettingell & Co., of Boston, recently moved into the large premises on the corner of Franklin and Congress streets, they determined to keep in stock everything in the electrical line, and by so doing make their business second to none among the electrical supply houses in the country. Being sole New England or Eastern agents for several prominent and popular Western manufacturers of electric light supplies, they are enabled to handle most of their goods at factory prices. They have been appointed New England agents of the Okonite Company, of New York, and the Phœnix Glass Company, of Pittsburgh, Pa., and will keep a full line of samples of the product of those concerns constantly on hand. New England dealers in electrical goods ought to appreciate the establishing of an enterprise of this kind among them.

The Electric and Machine Company.

This company manufactures all varieties of electrical apparatus and instruments; all kinds of light mechanical work, and it offers superior advantages to inventors and others engaged in designing, developing or perfecting electrical and mechanical apparatus and mechanisms. Its projectors and managers have had an extensive and varied experience in practical electricity and mechanisms, and their aim in all their work is to reach as high a standard as possible in excellence of design and workmanship. The large and well-equipped factory of this company is at No. 71 Sudbury street (near Scollay square), Boston, Mass. The officers of the company propose to contract for the manufacture of every description of electrical device and all species of light machine work. Among the latter their facilities are especially adapted to gear cutting, the making of special machines, tools, dies and screws. The premises are also equipped for nickel, silver and metal polishing. The factory, when run to its full capacity, will require 150 hands, and from present indications the employment of from 100 to 150 will be necessary in the near future. The workmen are the most skillful and experienced artisans that can be procured, and no effort is left untried to elevate the company's work to the highest standard in each and every respect.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., April 28, 1888.

Cape May.

The contest between the Cape Island Gas Company, of Cape May, N. J., and the Franklin Electric Light Company, culminated last Friday evening by Councils awarding to the latter a three years' contract for lighting the city with fifty arc lamps, to be paid for as follows: First year, $3,900; second, $3,800; third, $3,600. The lamps to be placed along the beach will be extra at the rate of thirty-five cents each per night. The company will now place a splendid plant, and will also introduce the incandescent light. The triumph of electric over gas lighting was hailed with delight by everybody.

The Haseltine Plant.

The Sawyer-Man Company have completed the wiring for the plant in the new eight-story building of the Haseltine Art Association on Chestnut street, above Broad. An 800-light dynamo is used, and a 100 h. p. Porter-Allen engine will supply the power. The fixtures are being furnished by Thackara, Sons & Co.

Sawyer-Man Plants.

Lang's Paper Mill, at 24th and Vine streets, has been furnished with a 150-light plant of the Sawyer-Man system.

No More Underwriter's Wire.

The Board of Fire Underwriters have passed an order that hereafter no Underwriter's wire shall be concealed in the wiring of buildings, even though it may be placed under moulding, or in any other form. This action was taken, it is said, on account of the danger resulting from dampness, and the complete exposure of the wires was the only remedy suggested. Any specially insulated wire may be concealed.

E. W. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, April 28, 1888.

The Addition to the Western Electric Factory.

The new addition to the factory of the Western Electric Company is about completed. It will be equipped with machinery and ready for occupancy by the first of July. It will increase the present capacity of the Chicago factory fully 50 per cent. All the departments of the Western Electric Company's manufacturing business will be extended and some new departments added to take up the additional space generally provided. Amongst the departments which are now crowded and require more room are the magneto bell and switchboard department, the electric light department, the insulated wire department and the foundry and Patterson cable department. The Western Electric Company proposes also to be in the field with electric motors. Covering as it does so many different classes of electrical work, it is always busy in some of its lines of manufacture. At present, multiple switchboards, Patterson cable, insulated wires and District Telegraph apparatus are pu ing it hardest. The Field & Firman 11 Call Box, which is manufactured exclusively by the Western Electric Company, and the reputation for which is wide, is being introduced in a number of cities where companies have found it wise to use a thoroughly well made box. Among the cities which have adopted this form are Omaha, Neb., Kansas City, Mo., Duluth, Minn., Milwaukee, Wis., and Toledo, O. The general business of the Western Electric Company so far this year compares favorably with that of last year, which was one of the most satisfactory years that it has had. The prospect is that in the line of electric lighting their business this year will be largely in excess of that which they did last year. Among recent contracts for electric lighting is one from the city of Dunkirk, N. Y., for 60 arc lights, the city buying it outright for its own use.

A New Accumulator.

There will soon be placed upon the market a new form of "accumulator," or storage battery, that, by the manner in which the lead plates holding the oxides are placed in the cell, prevents all danger from "buckling" or crumbling away, or "short circuiting." A large amount of surface is exposed to the action of the electric current, but this surface is in a very compact form. It is said to be already comparatively demonstrated by tests that the plates will remain intact and undisturbed from their original position for at least two years—a great saving when used for street railway service. A cell of the same size as the others now in use is said to be ten pounds lighter, shows very slight resistance in charging, and can be handled in a water pail if necessary. A patent has been applied for by Mr. Askew and Mr. Pumpelly, of Chicago.

The Inter-Ocean Electric Company.

On April 24, the Secretary of State granted license of incorporation to the Inter-Ocean Electric Company, of Chicago; capital, $100,000; incorporators, Samuel D. Snow, John E. Cooper, and Edward Maher.

The Mather Company.

Mr. J. H. Reid, manager of the western office of the Mather Company, has just returned from an extended trip to California, where he has been engaged in looking after the installation of some large plants. He reports having had an enjoyable as well as profitable trip. The business outlook for electric lighting seems to be very promising at present along the Pacific coast.

Central Station Steam Plants.

The Jarvis Engineering Company's Western Department, under charge of Mr. H A. Glasier, with headquarters at 81 Lake street, Chicago, is developing a large business in equipping central stations with that company's system of steam plants, one of the recent orders installed being the new Edison central station at Chicago, where the Jarvis furnace is adopted in connection with the Heine boilers, aggregating 1,200 h. p. The western slack coal makes excellent fuel for the furnace and effects a large saving as compared with the run of mine coal, which fact is being appreciated by those who make a study of the economical production of steam power. Mr. Glasier has been making an extended trip through the principal cities of the West and is much encouraged at the outlook for business the coming season.

Electric Lighting in Michigan.

Mr. W. F. Davidson, the agent for the Thomson-Houston Company for the State of Michigan reports the contract with the Ionia, Mich., company for two 30-lighters and one 500 incandescent machine. He has also contracted for the following business: a 30-light plant for the Tower Clothing Company, at Grand Rapids, using 15 arc lamps and 12 series 65 c. p. lamps, twelve 16 c. p. incandescent lamps from one machine and same circuit; also new plants at Eaton Rapids, and Kalkaska and 4 isolated plants in factories at Grand Rapids with several others about ready to close up in the State. The installation in the State of the Thomson-Houston system is increasing very rapidly. The people of West Bay City are about to start a daylight circuit, using several motors from their arc circuit wires. They are also contemplating the putting in of a street car service.

The Hotel Del Coronado, Cal.

The Hotel Del Coronado, at Coronado Beach, Cal., has the reputation of being one of the finest on the Pacific Coast. For a summer and winter resort its location is said to be most favorable. It has cost a million dollars to build, and the management will spare no pains to make it popular. Mr. E. S. Babcock, who, by the way, was formerly a telephone man well known in the East, is the president of the company which has constructed the hotel. Mr. J. B. Seghers, who was formerly manager of the Union League Club at Chicago, is the general manager. The hotel covers over an acre of ground and is surrounded by tropical plants of every description, flowers being in bloom the year around. Its electrical equipment is said to be most complete in every respect and is worthy of special mention, the installation just having been completed. Over 2,300 incandescent lamps of the Mather system with a large number of arc lamps furnish the light. There are 650 rooms and each has a thermostat connected with the Hess alarm guest call system, which is used and was manufactured and put in by the Standard Electrical Works of Cincinnati, Ohio. The case, which was made to order, of antique oak, is, I am informed, the largest ever built, measuring 11 feet by 8 feet and containing 650 indications and the same number of guest calls on the same board. It also has four switches on the board, which give an instantaneous and continuous alarm in each of the 650 different rooms. The electrical equipment of the establishment alone cost about $40,000 and is under the supervision of a thoroughly competent electrician.

The Baxter Motor.

It is encouraging to note the rapid growth here in the application of the electric motor in this city. The Baxter motor, which has been adopted by the Chicago Arc Light and Power Company, is already a general favorite, and the company itself says that it "has been found all that could be asked for." The Chicago representative of the motor here is recently in receipt, I might say, of a letter from Mr. W. H. McGrath, the superintendent of the Brush Company in New York. It runs thus: "Replying to your favor of April 3, in relation to the Baxter motor, we have eight or ten of them in use on our circuits, varying from 1 to 12 h. p. Some of them have been running for nearly a year, and we must say that they have given us little or no trouble. Our customers are very much pleased with the service they obtain from the motors, and as for efficiency, they are equal to anything in the market. We use them for almost all kinds of work, from a sewing machine to an elevator, and find they work equally well, and govern almost perfectly with varying as well as steady loads." Mr. McGrath's well-known position as an authority in all that pertains to electric lighting and central station work gives great weight to this testimonial, and I have no doubt that, as heretofore, Mr. McGrath's example will be followed, in adopting the motor.

Grate Bars for Lighting Plants.

W. H. Lahman, manufacturer of the Lahman-Kirkwood grate bar, 158 Lake street, Chicago, reports business unusually active for this season of the year, when the demand for new work is necessarily limited. The bars are now running some of the largest electric light plants in this city.

The Electrical Supply Company.

The Electrical Supply Company, 171 Randolph street, Chicago, of which Mr. F. S. Terry is the manager, carry a large stock of all kinds of electrical goods, and make a specialty of looking after Western trade. I know of hardly any supplies used by electric light, telegraph or telephone companies which I did not find on hand and in large quantities when I called the other day. Owing to the growing business, office and storage room is now being increased and the company hope to be in better position than ever to look after their customers. By special arrangement with the Chicago Copper Refining Company they are sole agents for that company's blue vitriol, and are consequently first hands. The Electrical Supply Company have also sole right to use the celebrated P. & B. electrical compound for the purpose of insulating wires. "P. & B." is now well known and a favorite with electric light men. For the convenience of western customers an office has been opened at 125 West Sixth street, Kansas City, Mo. This office is in charge of Mr. C. H. Cone, who is well known to most electric light people.

Leonard & Izard.

Leonard & Izard, electrical engineers and agents for the Edison United Manufacturing Company, report a very satisfactory increase in business, having recently done the wiring for upwards of 3,000 incandescent lights in Chicago alone. The outlook with them the coming season is very bright.

The Electric Construction Company.

I am informed that the Electric Construction Company, G. A. Harter, manager, has received contracts for wiring the big new Schandein House at Milwaukee, Wis., and also the W. H. Giles House, Chicago.

The Arc Light and Power Company.

The Chicago Arc Light and Power Company was organized in May, 1887, and immediately began operations by securing control of the Chicago Sectional Electric Underground Company, which owns an extensive conduit system on the north, south and west sides, and at the same time purchasing ten local plants—three from the Thomson-Houston Electric Illuminating Company, three from the Wunder & Abbott Illuminating Company, one from the Badger Electrical Company, one from the Western Electric Company and two from the Lake Gas Company, the latter covering the Stock Yards and Englewood districts. These plants have been gradually concentrated and are now incorporated in four stations, situated one in the rear of the cable line engine house at Clark and Maple streets, a second at 188 Washington street, the third at 76 Market street, and the fourth in the Lake Gas Company's building at 47th street and Stewart avenue. In addition to these, a new plant equipped with American machinery has been established at Chicago and Milwaukee avenues. With the exception of the Town of Lake circuits, all the wires of this company are underground, lead cables in conduits and under sidewalks (which in this city are excavated) being used, and although there have been a great many difficulties to contend with, it is believed the underground problem is nearer solution here than anywhere else in the world. The main station at 76 Market street will have, when completed, a capacity of 2,500 arc lights, and will in every respect be a model electric light station, no money or efforts being spared to make it as near perfect in every particular as can be done. There are many new features at this station that make it of special interest to all electric light men, notably the motive power, which at present consists of two 500 h. p. Williams' compound condensing tandem cylinder engines, the first of the kind ever built, and the method of transmitting the power from the engine to the main shaft, wherein a one-inch hemp rope passing over the fly wheel and shaft pulley ten times, is used. The company is at present operating some 1,500 lamps in the central part of the city, as well as a number of motors, the latter being a branch of the business not taken up until very recently, but so successful has it been that there is every reason to believe it will rapidly develop to such an extent as to become a very important feature. The officers of the company are as follows: B. E. Sunny, President; C. R. Cummings, Vice-President; A. F. Bennett, Secretary and Treasurer; F. W. Cushing, Superintendent, and J. A. Dyblie, Engineer.

The Central Electric Company.

One year ago last March Mr. Wm. H. McKinlock, who was well and favorably known in the electrical field, together with his brother, Geo. A. McKinlock, formerly auditor of the Michigan Telephone Company, came to Chicago and organized the Central Electric Company with Mr. M. T. Greene, who is the chief owner of the greatest lumber organization in the world, as president; Geo. A. McKinlock, treasurer, and Wm. H. McKinlock, secretary, securing a high class of manufacturers' specialties, among which being the Okonite wires and cables, Butler Hard Rubber Company's, etc. Their success has been phenomenal, and I take pleasure in chronicling it. Their sales of Okonite wires have been enormous, owing in part to the excellent qualities of this substance as an insulation, and the promptness with which customers have had their wants supplied, a large and varied stock being always on hand. Candee weatherproof wire is meeting with splendid success where its merits are known. The annunciator guest call and fire alarm of the Hess patent, handled by this company, is a very complete and superior machine, and is meeting with deserved success. The Central Electric also handle the Boston electric automatic and pendant burners for gas lighting, the Butler Hard Rubber Company's hard rubber sheets, rods and tubes, the National Carbon Company's electric light carbons and plates, the C. & C. motors and batteries, and the American Electrical Works' magnet wires and cordage. They have a factory at Columbia City, Indiana, for manufacturing pins and brackets.

Associated with them in this is L. S. Peabody, of Columbia City, a well known lumber merchant. Owing to the great increase in business the company will remove to 42 La Salle street May 1, where they will occupy four large floors and a basement. This will give them room to display their specialties and carry a large stock. Their success has been due to energy and push, combined with square and honest dealing, and the company is a good example of Western enterprise.

The Link Belt Machinery Company.

The Link Belt Machinery Company have erected for Zerse & Cenkey, in the Franklin Building, Chicago, a rope transmission which is probably the nearest perfect one of its kind ever put in. The building is a seven story and basement structure. In the basement is an engine of 120 h. p. The fly-wheel is grooved for the ropes, which after passing around a winding sheave and tension carriage pass up through a 4-in. pipe through the first, second and third floors. On the fourth, fifth, sixth and seventh floors sheaves are placed so that the single rope passing over them leaves 15 h. p. on each floor. Each sheave is mounted on a 4-ft. shaft, upon which a friction clutch pulley is placed which delivers power to the line shaft in the centre of each floor. The plan is practically equivalent to giving each floor an independent motor which may be started and stopped at will. The transmission is exciting a good deal of attention among electric light men in Chicago, and great credit is due Mr. T. S. Miller, an engineer salesman of the Link Belt Company, who designed and superintended the erection of the plant.

The Electric Construction Company.

This company are getting settled in their new quarters at 175 Randolph street, and announce themselves as ready for any kind of business in the line of electric wiring. They are now fitting up some of the finest houses in the country, among which is the $200,000 residence of Clem. Studebaker, at South Bend, Ind.; the residence of M. C. Bullock, of Chicago; that of Geo. S. Morrison, of Chicago, and many others. This company also manufacture and are putting on the market several specialties, among which may be mentioned the electric time recorder for watchmen, and they have also secured the agency for other specialties. The company has been in business a little more than a year and its business is rapidly increasing. The capital stock was recently increased to $25,000, fully paid in.

The Excelsior Company.

The Excelsior Electric Company, F. W. Horne, Western manager, has just made a contract to equip the Hotel Brunswick with incandescent and arc lights. This is the third hotel in Chicago which is being lighted by this system. Work upon the sixty arc light plant for the Union Stock Yards and Transit Company was commenced this week. It will require eight miles of wire, and the work of erecting the poles is under way, as is also the erection of the Ide engine, which is to furnish the power.

The City Plant.

Bids were opened on Wednesday of this week for the boilers and engines of the extension of the city electric light plant. The plant will be located in the fire engine house at the northwestern corner of Clinton and Washington streets, and as many lights will then be placed along the heavy down-town business streets as the limited appropriation will permit.

Chas. A. Schieren & Co.

have lately opened a branch house at 46 South Canal street, this city, which will carry a full line of their goods, standard short lap, electric and link belting; also a stock of both rawhide and tanned lace leather. Mr. Emil Gabel, who was formerly president of the Gabel Belting Company, of Chicago, will have charge of this branch.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$160@$165	Iowa Union	$26@ $27
Central Union	47@ 48	Michigan	78@ 80
Chicago	375@ 400	Missouri and Kansas	70@ 72
Colorado	19@ 21	Rocky Mountain Bell	40@ 45
Cumberland	65@ 68	Wisconsin	108@ 109
Great Southern	35@ 40		E. L. P.

CINCINNATI, O.

There is great expectancy here as to the Centennial Exposition. Mr. Luke Lilley has just taken charge of the Electrical Department of the Exposition, and is already very busily engaged wiring for 175 arc lights of the Western Electric system, and 175 arcs of the Waterhouse system, besides 1,000 lamps each of the Mather, Edison and Queen City Electric Company's incandescent systems. Probably he will have to place about 2,000 more by July.

MANSFIELD, O.

The Mansfield Gas Light Company has just completed at its gas works an electrical plant. The building is of brick, with boiler-room 24 by 24 feet, containing two 60-inch by 16 feet boilers. The dynamo and engine-room is 40 by 60 feet, with 18-foot ceiling and slate roof. The company is now running three 35-light dynamos of the Western Electric system, with one 60 h. p. engine and one of 120 h. p., furnishing 66 arc lights to the city for street lighting and 28 lights to merchants and others. There are at present 17 miles of circuits. Ten more lights are to be furnished to the city, and 2 miles more of circuit will be put up. The business is increasing so rapidly that it will soon be necessary to add another dynamo. The president of the company has been negotiating for an incandescent plant, with the object of adding that branch of the business during the summer. Good service is given, and all are being pleased with the candle-power of the lamps. The officers of the company are S. E. Bird, president; L. A. Strong, vice-president; J. S. Hedges, treasurer, and W. C. Hedges, secretary. G. S. Harris is the superintendent.

FORT WAYNE, Ind.

The Fort Wayne Jenney Electric Light Company was awarded recently the contract by the city of Little Rock, Ark., for 90 double lights for street service. The lights will be supported on four Star iron towers 125 feet high, and seven 60 feet O'Beirne patent mast-arms. The streets of Columbia City, Ind., were lit up a week or so ago for the first time with the Jenney lights. The Fort Wayne Company is now installing a plant of 400 lights of the alternating system in Columbia City, and a plant of the same size at Plymouth, Ind. A plant is now being installed at New Orleans, soon to be in running order, with 5,000 incandescent lights, on the Slattery alternating system. The Jenney Company is also putting in a plant of 100 arc lights at Houston, Tex., suspended on 100 O'Beirne mast-arms at the intersections of the streets.

They are at present raising the old buildings and making them three stories high. Another building is to be commenced next month three stories high. The manufacturing capacities are being greatly increased in all the different departments. The alternating system is increasing so rapidly that in a short time it will occupy the entire buildings. Their daily output at present is one dynamo per day, ranging in capacities from 800 to 3,000 lights each, and 30 transformers from 10 to 100 lights each, 50 and 100 volts. Mr. Slattery, with his able assistant, Mr. Mackie, has running in successful operation their new arc light transformer, it not being much larger than their incandescent 10-lighter. This department alone employs 180 hands. The arc department, like the others, never had such bright prospects ahead. It is making 450 arc lamps per month, that being the limit of their present manufacturing facilities. The incandescent department is rapidly increasing in all its branches. The new pump room for exhausting the lamps is just completed. It occupies the entire floor of the third story of the new building. It contains 250 automatic vacuum pumps of the company's own invention, making a capacity of 5,000 lamps per day. The pumps are arranged in five rows of 50 each. The lamps, while undergoing the process of exhaustion, are supplied with the alternating current obtained from a transformer with which every pump is supplied. The entire room is handsomely finished in wood and varnished. It is also supplied with all the modern and improved instruments requisite to make it one of the most perfect and most fully equipped rooms of its sort in America.

JERSEYVILLE, Ill.

The plant of the Jerseyville Electric Light, Gas and Power Company, consisting of two No. 10 Edison dynamos, was installed by Leonard & Izard, of Chicago, and light was turned on December 3 last. They began with 57 32 c. p. street lamps, and 200 16 c. p. lamps in business houses and residences. Since that time they have added about 60 16 c. p. lamps in business houses and residences. They use an Armington & Sims 75 h. p. engine, and have never had a stop of five minutes yet during the hours for lighting, which are from dusk until midnight. They are located on one corner of the Court House Square, having put up a neat brick building 26 × 65 feet. It is generally conceded by visitors that they have the finest plant of its capacity in this part of the country. No expense was spared in putting up everything secure, substantial, and of the best material. The city has a population of about 4,000. It has made strenuous efforts to secure a supply of water, and is now boring an artesian well, being down upwards of 1,500 feet, and boring in St. Peter's sandstone, below which it is hoped will be found a good supply. The neighboring town of Carrollton has in contemplation the putting up of a Brush arc system of 25 lights for its streets. The officers of the Jerseyville company are: J. G. Schwarz, President; W. Leigh, Vice-President, and W. E. Carlin, Secretary and Treasurer.

OTTAWA, Ill.

The Thomas Electric Light and Power Company, of Ottawa, Ill., organized in 1884 with two Thomson-Houston dynamos, has recently increased its stock from $10,000 to $15,000. The plant now consists of three dynamos, one 30 and two 25-lighters. A new central station has been built, with a 150 h. p. turbine wheel, placed in ¼-inch boiler iron, 4 feet diameter, 26 feet fall. The iron cylinder, extending from the hydraulic basin to the wheel pit, is set in solid masonry, thus securing the most substantially constructed work of its kind in the State. The company is in a thriving condition, with ample facilities to take care of the future growth of its business. Its officers are: William Thomas, president; Col. D. Hofman, secretary and treasurer; with five directors, H. M. Hamilton, Lorenzo Leland, Wm. Thomas, Col. D Hofman, C. L. Ballard. The last named is the electrician in charge. He is also manager of the Western Union office.

DETROIT, Mich.

Detroit presents the most extensive electric lighting plant in the world. The entire city, embracing 21 square miles, is wholly lighted by the tower system, and has been for four years past. The Brush Electric Light Company owns the entire plant and the whole is operated from one station. There are many circuits of more than 25 miles in length. The Brush Company's works are of brick and very extensive. A large boiler room, 150 by 55 feet, has ten boilers, and a railway switch track runs through in front of the boilers. Adjacent to this is a room for large engines, in which there are two Wright-Corliss engines, 20 by 42 inches each, and one Cummer engine, 18 by 36 inches. This room is 45 by 65 feet. Beyond this again is a two-story brick building, the first floor being devoted wholly to engines, and the second story to dynamo machines. This building is 55 by 105 feet, and the lower floor opens into the large engine room above named throughout its whole length.

The floor above is made of 2 inch by 5 inch pine laid on edge and spiked together, and on top of this is a diagonal flooring of oak one inch thick. The floor is supported by girders nine feet apart, and by oak posts dressed and rounded. The entire first floor on all the buildings is of brick laid on edge. This station is a model structure, with capacity for 3,000 arc lights. There are employed for public lighting 122 towers of 150 feet each, with interior elevators, whereby the lamp trimmer ascends to care for his lamps. The towers were made by the Detroit Electric Tower Company, and are specially adapted for cities and towns. They each stand on a single pillar at the base, 14 feet high. Above this is a straight trussed triangular structure.

A new motor is being made here by the Franklin Electric Motor Company, which is not yet incorporated, nor as yet actively in the field of business. The motor the company has is the invention of Eugene Eastwicke and is distinguished by its simplicity of construction and the ingenuity and entire originality displayed in the mechanism of its spoke armature. A feature of the motor which makes it especially valuable for sewing machine purposes is that it takes the entire current at once and starts *instantly* with *full* power. The motors that the company have already built, ⅛, ⅓ and ¼ h. p., have been constructed more as experiments than for sale, yet it is a fact significant of the excellence of the motors that those so built have been disposed of in this city as soon as made. A personal visit on the part of the writer, who is not connected in any way with the company, to four establishments where the motors are employed, one of them using nine, showed that the motor has given entire satisfaction, giving more power than was claimed for it, being so little liable to burn out that it does not even heat, and requiring the minimum of attention and no repairing of any kind. "I would not take $500 for my motor if I could not replace it," was the emphatic endorsement of a dentist who is using a ¼ h. p. motor to run his lathe.

The Edison Illuminating Company now have over 8,000 lamps in use, with the demand growing faster than the company can fill.

The new Grosse Pointe Electric Railway has not yet gone into operation, but no doubt will very soon.

Application was made to the Common Council last night for the use of certain streets for two new street railroads, one to be run by electricity from storage batteries.

The Electrical Accumulator and Lighting Company, of Detroit, have in the past ten days started their central station lighting plant, the first 125 h. p. engine with two large charging dynamos now being in operation. The plan upon which this station is being installed differs materially from any other accumulator plant in the United States. The batteries are placed upon the charging circuit, which is of No. 3 or No. 4 wire, in series, and the lights run from the accumulators in multiple arc. The standard charging current will be 40 ampères, the station being run through the heaviest load, and instead of having storage capacity for, say 100 lights in each battery, it will be but for 50 lights. They have adopted the Sawyer-Man 60-volt lamps, requiring $\frac{8}{10}$ of an ampère. Fifty lamps therefore will take 40 ampères, and 100 lamps 80 ampères. If the heavy load averages say four hours, during this four hours the lights would be taking the direct current from the dynamo and 40 ampères from the battery, the charging having been begun from five to six hours before the heaviest load is on; the accumulators are thus fully charged and ready for work. The charging is then continued for two or three hours, depending on the work required for the next day. Under this manner of installation but half the storage capacity is used and the work put on the battery is lighter than when running under the stored current entirely. An absolutely steady light is obtained; the charging current can be carried any distance, and the direct current being used for more than half the load, a higher efficiency is obtained. The company here have had a large number of plants in use for some time, and have satisfied themselves as to the economy of this style of system and intend putting in a plant with a capacity of from 8,000 to 10,000 lights. Some of the largest buildings in the city have already been contracted with to light under this system. The company are also beginning operations in the State, and have already installed plants at Flint and Menominee, Mich., while at other points they have plants under way. The company consists of some of the best people in Detroit, who are quite pleased with the outlook of the business. Between 3,000 and 4,000 lights have been contracted for during the past 30 days. They furnish the light under the contract system, the consumer furnishing renewal lamps. The company seem much pleased with the Sawyer-Man lamps, which are very long-lived, and retain their brilliancy to the end. The City Hall building, containing about 400 incandescent lights, will be in operation shortly after the first of May. The company have a very neat and compact power station adjacent to the river front, and will shortly add more engines and dynamos. They use a special type of dynamos, having a current capacity of forty ampères at an E. M. F. up to nine hundred to one thousand volts, thereby enabling us to charge from ten to twelve series of batteries of from thirty-two to thirty-four cells each, each series having a capacity of one hundred lights. Mr. G. E. Fisher is the general manager.

The Woodward Electrical Company, under the management of C. D. Whitcomb, is fast getting in shape to manufacture storage batteries, under the patents of Mr. Woodward, of London. The building in which they began making their batteries has now proven too small, and they are looking for new quarters, with larger buildings and plenty of ground for future enlargement. The company have fitted up an office in the Campau Block in Griswold street in the most substantial manner. In addition to room for the transaction of their rapidly growing business, they have a large battery of their storage cells. To charge these they use an Edison No. 2 dynamo, driven by a 7½ h. p. Sprague motor, the current for which is supplied from the Edison central station. A series of lamps of various capacities are so arranged that the power of the cells to light a single room, a railroad car, church or large building can be shown. They also have motors of various sizes on exhibition run by current supplied from the cells. A storage plant of 300 cells has been put in at Petosky which is giving good results.

The Thomson-Houston Electric Light Company, of Detroit, has grown during the last year from a plant of 200 lights to one of 300, and is still unable to fill many orders received of late for motors, day arcs and incandescents, the reason being its limited capacity. The company is also operating about 700 Sawyer-Man incandescents of 16 c. p. on the arc circuits, with the most perfect success; also about 60 of the series—10 ampère—lamps. Mr. J. L. Hudson is the president of the company, Mr. E. B. Wendell, secretary; Mr. W. H. Elliott, treasurer, and Mr. J. E. Lockwood, general manager.

GRAND RAPIDS, Mich.

The Edison Light Company here made a temporary start on Tuesday, April 10, and furnished light (75 lights) for a reception given to the governor and staff at Co. B's Armory. The feeders are not yet laid, in fact the Callender people began work only on April 13, but the company ran temporary overhead lines. It was a grand success, every body remarking on the steadiness of the lights, and the low, cool temperature of the room. There were about 200 couples present. The lights were started up before seven and shut down about four, a pretty good trial test, with not the slightest mishap. The work at the station is nearly completed, and all the *overhead* work is done, except running a few services

The feeders, which are all to be Callender underground cables, are the only thing which are awaited. If the company has good luck in getting ready it will start about May 1, with about 4,000 lights, possibly more—meter system. The officers of the company are: D. McCoy, president; W. F. Bulkley, vice-president; C. M. Ayer, secretary and treasurer, and J. W. Crosby, superintendent.

IONIA, Mich.

The Ionia Electric Company has been formed with a capital stock of $25,000, all paid in. Mr. L. B. Townsend is the president, Mr. J. E. Post secretary and treasurer. The company has contracted for a plant of the Thomson-Houston system, as well as for a 100 h. p. Ball engine, with two boilers of 100 h. p. each, of the Phœnix Iron Works, of Port Huron. It will have 5 miles of circuit for the present. The contract for construction of the building has been awarded, and the company hopes to be ready for business within 60 days.

STURGIS, Mich.

The electric light plant of the Sturgis Gas and Electric Light Company consists of two Edison No. 8 dynamos of a capacity of 300 16-c. p. lights. Each dynamo is belted direct to a 70 h. p. engine built by the Taylor Manufacturing Co., of Chambersburg, Pa. Steam is supplied by an 80 h. p. boiler made by C. H. Dutton & Co., Kalamazoo, Mich. The company began the installation of their plant Dec. 5, 1887, worked right through the winter and started the engine on Thursday, Feb. 3, this year. On the next night lights were turned on for the first time. The plant is located near the centre of this thriving little city, in a white brick structure, and is a source of great interest to all visitors. The streets are lighted with 35 32-c. p. incandescent and 50 16-c. p. incandescent lights, which are giving perfect satisfaction. The light has been introduced into nearly all of the business houses, hotels, churches and into many dwellings. The probabilities are that in the course of a year the company will be obliged to duplicate their present plant or put in the storage battery system. The officers are: H. L. Anthony, president; E. T. Parker, vice-president; H. A. Clapp, secretary; F. W. Wait, treasurer, and W. C. Grobisher, superintendent and manager.

HOUGHTON, L. S., Mich.

The only central station plant in the Upper Peninsula of Michigan, aside from the one at Menominee, Mich., is the plant here. At Menominee they use the Brush system of arc and series incandescent, three machines and two high-speed engines. They will probably increase to another machine the coming summer. Here the company have four Thomson-Houston machines (three 30 lighters and one 45 lighter; two high-speed engines, 60 h. p. each, one Ball and one Porter. There are a number of private plants in the district, ranging from 10 to 50 lights. The Osceola Mining Company have a 25 Western Electric arc machine. The Tamarack Company have two Ball machines of 25 lights capacity. The Calumet & Hecla Mining Company have four Brush machines, all arcs.

The Calumet & Hecla Smelting Company have a 15 arc and 75 incandescent of the Thomson-Houston system. The above are all in Houghton County and doing good service. In Marquette County there are also a number of private plants in use at the different mines, mostly of the Brush system. On the Menominee range, in Menominee and Iron counties, there are also a few private Brush plants in use at the mines. At Escanaba there is a small Brush central station. They have one 45 arc machine. The electric light business in the Upper Peninsula of Michigan is not growing as rapidly as it might, but is steady, with fair prospect for increase during the next few years. New installations have been talked of at different points, particularly at Ishpeming and Marquette, but it may be some time before they conclude to put the apparatus in. At Ishpeming the council have decided to use gas. There is a gas company at Marquette, but the people want electric light, and I have no doubt that Ishpeming will want the same after she has a good taste of the gas.

The telephone business in a scattered territory, as this is, might be classed as good, although there is a limit to it. There seems to be no fault to find with the service and no craving for bogus telephones. There are a few Cushman telephones doing private line service, but the decision of the Supreme Court has put a damper on them, and from what I can learn they are giving very poor results.

The Western Union is the only telegraph system connecting the towns and it is doing a fair business; but I think the telegraph, like other electrical business in this section, is limited. The demand for housework and electrical supplies is also very limited, though Mr. J. R. Dee works up very promptly all there is.

MINNEAPOLIS, Minn.

The Minneapolis Electric Company, wholesale dealers in electrical supplies, are doing a nice business, and bids fair in the near future to be a "landmark" in the Northwest. They are the agents for the Okonite Company and the sale of this wire is daily increasing.

The Minnesota Brush Electric Company are now running eighteen dynamos, and are furnishing light and power equivalent to one thousand arc lights. Under the efficient management of Mr. S. S. Leonard, their business is constantly increasing.

At the last regular meeting of the Minneapolis Electrical Club, it received as a donation a pair of large and very powerful electro-magnets from Messrs. Bell & Co., and a large and very sensitive galvanometer for lecture purposes, made and presented by the Minneapolis Electric Construction Company.

The Minneapolis Electric Construction Company are doing a very good business, the result of their efforts to please their patrons. They have put in electric gas lighting in the People's Theatre and several churches. They are now putting in a very complete outfit of call bells, burglar alarm and gas lighting in the new residences of Judge J. M. Shaw and Mr. B. S. Bull. Mr. Bull is having his gas-lighting connected with his burglar alarm, so as to light the gas in any or all rooms should a burglar attempt to enter. They have also planned and just completed a very perfect system of speaking tubes and call bells for the large grocery house of Geo. R. Newell & Co., which proves very satisfactory to the firm.

Mr. F. C. Turner, agent for the Mather Electric Company, reports the following orders taken for incandescent electric lights, and running or being installed in this vicinity during the year ending April 12, 1888: Hennepin Theatre, Minneapolis, 800; Diamond Mill Company, 150; Blair Apartment House, St. Paul, 500; Bohn Manufacturing Company, St. Paul, 250; State Capital Building, St. Paul, 650; Manitoba General Office Building, 600; Indurated Fibre Company, Winona, 100; Oliver Wendell Holmes Hospital, Hudson, Wis., 150; Upham Manufacturing Company, Marshfield, 200; grand total, 3,400.

BELOIT, Wis.

There has been considerable talk in Monroe and Darlington, Wis., of putting in central stations, Darlington to run by water power and Monroe by steam. Mr. W. A. Knapp, of Beloit, has given them estimates on the Ball system, and the Excelsior, and they have had bids on Heisler incandescent, Edison, United States and other leading systems. Rice Lake, Barrow and Cumberland, Wis., each have had some talk of establishing central stations. In Janesville incandescent lighting has been talked of considerably. Mr. Knapp is now using here the Ball 4 ampère arcs with success. He is also using United States incandescents and Excelsior arcs for street illumination, and is in hopes of getting water power to operate his plant here. He has offers pending to that end now.

MADISON, Wis.

It had been stated that an electric light plant would be put in by the city of Madison. A franchise has now been granted, however, to G. W. Gilman, J. C. Woodward and J. W. Hudson for electric lighting, with the provision that the company cannot sell out or combine, its privileges for the next five years being transferable only to the city itself. The Thomson Houston system is to be installed, and the plant will be running in sixty days.

SIOUX CITY, Ia.

The electric light company here began work on April 16, wiring for the Westinghouse system for incandescent lighting. It has contracts for 600 lights and will probably put in two 650-lighters. It is to have also a 35 light arc machine of the Thomson-Houston system. It is also running 40 lights of the United States system. It has contracted with J. P. Allen, who represents E. P. Allis & Co., of Milwaukee, for a Corliss engine of 200 h. p., four steel boilers, shafting with clutch pulleys, and everything complete ready for the belt. A lot has been bought at a cost of $9,000, on which will be put up a building, 50 by 100 feet, to cost about $5,000. Into this will be moved also the old plant consisting of a U. S. 50-lighter and a 65 h. p. Buckeye engine. The company expects to be running in sixty days.

DES MOINES, Ia., April 25, 1888.

This city has three systems of electric light: the Edison incandescent, the Thomson-Houston arc and the Van Depoele arc. The two latter have been purchased by the Capital City Gas Light Company, who, it is understood, are going to consolidate them. Hence there are but two competitors here, and the Edison Company, though fighting against heavy odds, has each year shown an increase. The past winter they had all the lights connected that they could carry, their capacity being 3,200. The gas company are talking of running incandescent and the Edison Company arc lights, but it is generally conceded to be only talk. Electric motors are all the rage here now, and Mr. Woodruff, the motor agent, is pushing the business hard with excellent success. There are twenty-five motors now here and the number will probably more than double this year. They are used on printing presses, coffee mills, blowers, elevators, fans, horse cleaners, lathes, pipe organs, pumps, hay hoists, sewing machines, telephone generators, electroplating dynamos, milk shakers and paper folders; two being 5 h.p., two 3 h. p., and others smaller. In make they represent Sprague, Van Depoele, C.& C., Bergmann, Hawkeye and Cleveland, Sprague being in the lead. The Sprague motors were first put in three years ago. Not one of them has ever given any trouble nor could one be bought to-day at 10 per cent. reduction from the purchase price of two or three years ago. There may be another motor made that equals it, but it would not be an easy matter to convince the people of Des Moines so. I must not forget the three or four electric street railways prospected for this year, but the operation of which has been postponed on account of an injunction issued in favor of the horse car company, who claim the exclusive right for ten more years. They have had it for twenty already, and there is nothing mean about them. There is much talk of some new electric companies starting here this summer, and as much of the city is still unsupplied, while gas is $2 a thousand and coal only 50 cents a ton, the people are expecting them and most new buildings are being "wired," even when three or four miles from the present "station." By the way, Des Moines is now enjoying a "Western boom," and electricity seems likely to reap some of the benefit therefrom.

OTTUMWA, Ia.

The Edison Company, of this city, will, as soon as their machinery is in shape, start a motor circuit of not less than 50 horse-power, and arrangements are made to use the Thone motor, made by the Hawkeye Company, of Oskaloosa. The Johnson Ruffler Company will this summer increase their present electric lighting plant to 300 or 400 lights.

OSKALOOSA, Ia.

A shocking state of affairs exists in this city. The Edison Company have a plant of 2,000 lights. The gas company are running Westinghouse and Jenney (Indianapolis) lamps. The Hawkeye Electric Manufacturing Company are building electric lighting apparatus of all kinds and electric motors. Seibel & Esgen Flouring Mills, the Oskaloosa Water Company and the Seevers Manufacturing Company have put in isolated plants. Arrangements are about perfected for an electric street car line, and one of the large Eastern incandescent lamp manufactories contemplate coming here with their shops. In fact the very air is so full of electricity in this city that a stranger will immediately wear his hair pompadour in spite of himself. If his "bearings" need lubricating, he will have to make a short circuit on one of our prohibition drug stores. If his constitution has sufficient (ohms) *resistance* to withstand all this, he will in addition have to stand a *constant current* of electrical chatter, for everybody who can dig a pole-hole thinks himself an electrician. Now that all the printing presses of this city are running by Thone electric motors in all the various printing and newspaper establishments, they no longer advertise themselves as being steam printing-houses, but say their newspapers, etc., are "struck by lightning."

KANSAS CITY, Mo.

The following is from the Kansas City *Commercial* for April:

No city in America is better equipped with electric light and power than Kansas City, there being already in operation the Kansas City Electric Light Company, the Sperry Electric Light Company and the American Company, while the Edison, which is now operating with a temporary plant, will, by Sept. 1, be the most complete electric institution in the West. The capacity of the Sperry Company is 300 arc lamps; that of the American Company, 100 arc lamps. The Kansas City Electric Light Company is the pioneer in the West, having been organized in 1881, and was lighting the town by the spring of the following year. They use the Thomson-Houston arc system, the Sawyer-Man incandescent system, and are installing a plant of alternating-current apparatus for long distance incandescent lighting, which will enable them to illumine not only the resident district of Kansas City proper, but all outlying suburbs. The plant has cost over $300,000, and has a capacity of over 850 arc lamps (725 of which are in service) and 1,500 16 candle-power incandescent lamps. They have nine engines ranging from 75 to 250 horse power, and are supplying power to a number of light manufactories by means of the electric motor, which is the friend of all small industries, and is welcomed by landlords because it cuts down the fire risk. The building of the Kansas City Electric Light Company, near the Union depot, is a substantial two-story brick structure, 50 × 110 feet, with a smoke-stack 125 feet high. Every dollar of this investment is Kansas City money, the stockholders being all representative men who have for years been identified with the interests of the city. Mr. E. R. Weeks, the general manager, has been for twenty years a wide-awake believer in the future of the city—a man who has shown his faith by his works. The Edison Electric Light and Power Company has a capital of $350,000, and its new plant will be permanently installed by Sept. 1, 1888, with a capacity of 35,000 incandescent lights, with underground wires. The station will be a substantial five-story fire-proof brick building, with appointments that will make this a model station. The Edison company will confine its operations to incandescent lights and the supplying of power, which latter will range from 1 to 40 horse power. Thus are the inducements for manufacturing establishments in Kansas City being multiplied, and it is only a question of time—and a short time at that—when Kansas City's industrial supremacy will be unchallenged in all the region west of the Mississippi River.

KANSAS CITY, Mo.

The Kansas City Electrical Works have just reorganized under the laws of the State of Missouri with a capital stock of $10,000. The stockholders are E. L. Martin, G. M. Myers, W. H. Woodring, C. E. Kearney, W. J. Terry and C. G. Perrin. The first named is president; Mr. Kearney is vice-president, Mr. Perrin is secretary and treasurer, and Mr. Woodring, superintendent. The company was first organized in July, 1886, and has been quite successful in building up a large business. The Home Telegragh and Signal Company has also been reorganized with a capital stock of $100,000, and will be hereafter known as the Home Telegraph Company. Its object is the owning and operating of telephone and telegraph systems and the maintenance of a messenger and signal service. The Kansas City Electrical Works have the contract for, and are now putting in, a "Porter electric messenger" for the new 200-room hotel at Excelsior Springs, Mo. By this system a guest can telegraph his wants from his room direct to the office.

ST. JOSEPH, Mo.

The Union Railway Company has a large force at work relaying their track and erecting poles for changing their motive power from horses to electricity. The first installment of eight cars will be equipped in about four weeks, and later in the summer additional cars will be placed on the line till the entire distance of five miles is changed over. A large brick power station, 55 × 60 feet, was erected last year and fitted with two boilers of 90 horse-power in the aggregate; an Armington & Sims engine of 75 horse-power and two dynamos of an aggregate of fifty thousand watts. On one mile of track north of the city limits all manner of experiments were made during the past nine months with two cars equipped with Sprague motors. The severe winter, deep snows, sleet, rain, mud and other trying conditions under which the cars were operated, satisfied the Union line directors of the advisability of adopting electricity as a motive power, and they closed a contract with the Sprague Company for the equipment of the entire line. Last Sunday a car supplied with but a single motor of 7½ h. p. repeatedly carried loads of 60 and 70 passengers, making the round trip of two miles, on which there are two four per cent. grades, in 10 and 11 minutes, including one minute wait at each end of the mile track, carrying altogether over 1,900 passengers during an afternoon and evening. This was considered good work—more than is asked of the new cars, which are to be equipped with two 7½ h. p. motors each. Mr. S. Jenkins is president of the company; Mr. A. Steinacker, secretary and treasurer, and Mr. C. S. Wilson, superintendent.

ST. LOUIS, Mo.

The Pike Electric Company are meeting with great success in placing the new Cleveland motor, for which they are sole agents in this territory. At present they are furnishing shoe factories, printing houses, hosiery mills and other manufacturing concerns with power through the agency of this motor, and also running several ventilating fans of large size.

They are representatives here of the "American" system of arc lighting, and have several sales of importance in prospect.

The Excelsior Electric Company of this city, recently reorganized under a new and strong directory, are rapidly extending their already large business, and are contemplating trebling their arc light capacity, as well as adding an incandescent system for city lighting on a large scale. They have lately commenced the sale of power, which now comprises an important part of their business.

Mr. Chas. Stagl, a graduate of the Polytechnic Institute at

Vienna and Karlsruhe, and an electrician of great and varied experience, having been connected during the past ten years with various companies in this country and abroad, has established himself as consulting electrical and mechanical engineer at 708 So. Third St., St. Louis. He is making a specialty of testing dynamos, motors and all electrical apparatus, and also accepts contracts to adjust electric light and power plants which have been working unsatisfactorily, also perfects and improves new inventions. He is at present consulting electrician of the Pike Electric Company of this city.

HIAWATHA, Kan.

The Hiawatha Electric Light Company are now erecting their pole line. The dynamo, a 35 light 2,000 c. p. of the American system, is now on the ground. A 60 h. p. New York Safety engine is on the road. The company expect to have the plant in operation by May 1. Mr. J. G. White, of the Western Engineering Company, Lincoln, Neb., is the contractor for the entire plant. An incandescent system will be added as soon as the demand will justify it. The officers are: G. H. Adams, president; W. M. Shirley, vice-president; J. Schilling, treasurer, and C. H. Lawrence, secretary. The capital stock is $20,000.

TOPEKA, Kan.

The city is putting in a Jenney plant of 120 arc lights. The dynamos are run by Ball engines of 70 h. p. each. Four 35-light dynamos furnish the current for the lights. The plant is expected to be complete by June 11.

The Brush Company have recently put in a 150 light Brush incandescent dynamo with corresponding lights. The Topeka Starch Works have a small 25-light Brush incandescent plant. The Shawnee mill have a 40-light Edison plant. The Edison Illuminating Company have connected to their station over 5,000 lights. No fewer than 90 residences are supplied with light, and some of them are a mile distant from the station. The light gives good satisfaction, and the company propose to enlarge their station as soon as possible. Beside the incandescent business the company have connected to their circuits 31 motors aggregating 119 h. p., distributed as follows:

	20 h.p.	10 h.p.	7½ h.p.	5 h.p.	3 h.p.	2 h.p.	1½ h.p.	1 h.p.	½ h.p.	⅛ h.p.
Printing offices	1	2	2	3	1	1	1	....	3	....
Blacksmith shops	....	..	....	1	....	....	..	....	1	....
Hoisting stone for State Capitol Building	....	....	....	3	....	....	.	....	....	....
Carpet cleaning establishments	....	....	..	1	1	....	....	....	....	....
Spice mill	....	....	....	....	....	....	1	....	....	..
Pumping water for mineral well	.	....	....	....	....	....	1	....	....	....
Ice cream freezers	....	....	....	1	....	....	2	1	....	....
Jeweler	....	....	....	..	....	....	..	..	....	1
Telephone office	....	....	.	....	....	....	....	....	....	1
Dentist	....	....	....	..	....	....	....	....	....	1
Restaurant	....	....	....	....	....	....	..	....	....	1

Several new business blocks that are in process of construction will have 10 h. p. motors for running elevators.

HUTCHINSON, Kan.

The Hutchinson Water, Light and Telephone Company owns and operates a Holly system of water-works, an Edison incandescent system, a Thomson-Houston arc system and a Cusbman telephone exchange, all being under the one management. The combination is such a happy one, and the departments are each so complete, that it has attracted visitors from almost every State in the Union. In the electric light department the company has 6 Edison dynamos of 2,400 lamps capacity, 1 Thomson-Houston 50 lighter and three Armington & Sims engines of 250 h. p. aggregate. A fourth engine is soon to be added so that the arc capacity may be increased. A battery of 5 boilers supplies steam to both departments. The telephone exchange is growing rapidly, and the 200-line switch-board is nearly full. The city is but 14 years old, and has increased since the building of the plant was begun two years ago from 5,000 to 16,000 population. The company has about $236,000 invested, and the earnings yield a very satisfactory dividend. Mr. G. C. Millar is president, Mr. J. S. Drake vice-president, and Mr. L. A. Beebe secretary, treasurer and manager.

HORTON, Kan.

On Feb. 1, the Citizens' Light, Heat and Power Company, of Horton, Kan., was organized and incorporated under the laws of Kansas, with a capital stock of $10,000 paid up. The company holds a 20 years exclusive franchise with a city contract for the same time, for street lighting. The company at once made a contract with the Hawkeye Electric Manufacturing Company to put in a plant for them, to be completed in 90 days. Thus, although the town is little more than a year old, it will have betore June 1 no fewer than 20 arc lights of 1,200 c. p. on the streets, and will have more than 450 incandescents in its stores and residences. Mr. W. P. Todd is the president. He is senior member of the real estate firm of Todd & Smyth.

LAWRENCE, Kan.

The State University of Kansas, at Lawrence, is equipping a department of practical electrical engineering. An engine-house, costing $16,000, for the dynamos and heavy electrical apparatus, was erected last summer, and $5,000 is now being expended in equipment. The physical laboratory is excellently well provided with a large variety of galvanometers, resistance coils, potentiometers, etc., about $3,000 worth at present, from Edelmann, Hartmann, Elliott Bros. and other best European makers. The Board of Regents are thoroughly in earnest to make this course in applied electricity equal in facilities and in thoroughness to that in the best Eastern institutions. The course embraces two years' study of French and German, three years of mechanical drawing, together with complete courses in physics and chemistry and practical work in the chemical and physical laboratories. The facilities for mechanical work are being continually added to, so that the young electrician learns the use of tools and machinery, constructs various electrical apparatus, handles the dynamos, etc.

A 35 h. p. Armington & Sims engine provides power for a complete American arc plant now being put in, and for the machinery in the work shops. Direct and alternate current incandescent plants will be added in the fall. Thus the course is intended to be so practical as to provide broadly and technically trained young men for the growing demand for educated electricians.

Lawrence, the seat of the State University, has an Edison, a Thomson-Houston, a Western Electric and an alternating system in operation, and with Kansas City only an hour's ride distant, the students in electrical work have excellent opportunities for inspecting, testing and acquainting themselves with the latest electrical inventions. Kansas is the first State university to recognize the growing importance of the electrical engineering profession, and the excellent opening in it for young men. It is the only university between the Rockies and the Mississippi with facilities for such a course.

LINCOLN, Neb.

Nebraska is a State that is as yet rather sparsely settled, consequently there in little electrical activity to record compared with that in Kansas, Iowa, or Missouri. There are sixteen towns supplied with electric light from central stations. These stations range in capacity from thirty arc lights to two thousand incandescents with one hundred arcs. In the total of sixteen towns, five have had plants installed since last September, and in four of the five cases the installation has been made by the Western Engineering Company, of this city. This company has been endeavoring to make a record of excellent work in the construction field, and the heavy sleet storm which passed over Nebraska a few weeks ago thoroughly proved the quality of their work. The sleet was heavy enough to even cause the face of the genial manager of the Lincoln District Telegraph Company to wear a long expression as he rustled to find repair men. Many of the electric light plants in this State suffered a great loss in damaged lines and rebates on light, but the plants installed by the Western Engineering Company suffered no accidents, and lost no rebates. At present this company is installing an arc plant at Hiawatha, Kan., which will, doubtless, be the crack plant west of the Mississippi River. The plant consists of American arc machinery and New York safety steam power engine. The 3½ miles of line is No. 6 Candee wire placed on 30-foot and 40-foot poles, all of which are painted.

At this time Eastern Kansas is apparently the camping ground of agents from all parent electric light companies. Bids from eight different companies were opened not many weeks since in one town. The plant was one of 35 arc lights. Representatives of several companies besides those bidding had visited the town to look after their respective interests. Possibly the sharp competition in the field is the cause of the hard luck suffered by the agents of one company during the past year. Their first agent placed in Nebraska retired from the field shortly after entering it to take the management of a district telegraph system (where, by the way, he has made a great success). His successor died at his post. A third agent appointed to the territory cancelled his agreement and left the territory in disgust at his lack of success; and now the fourth has just been seized with a severe attack of nervous and mental prostration after being on the ground but a short time.

An interesting experiment is about to be performed in the City of Lincoln. The city water supply is drawn from a mammoth well. A small bore was made in the bottom of the well to increase the supply. Unluckily this yielded brackish water, and an unsuccessful effort was made to plug it. It is now proposed to use an incandescent lamp to illuminate the bottom of the well, when the condition of the present plug can be inspected, and it is thought that with the aid of this light the plugging can be made tight. The well contains a goodly amount of water, and the lamp will be attached to a duplex Okonite wire to be lowered into the depths. The Lincoln Electric Light Company are now extending their lines to the city water-works in order to try the experiment.

OMAHA, Neb.

The Nebraska Telephone Company is entering actively upon the work before them for the year. The number of applications for telephones in the city of Omaha is very large. The city contains about 120,000 people. The company has 1,200 subscribers, and one of the very best systems in the country, using a Western Electric multiple switch-board with a special clearing-out drop which enables each subscriber to call the other for himself. The system has been found to work very satisfactorily, and rapid service is given in consequence. Applications, which are altogether voluntary, are averaging between 50 and 60 per month. The Nebraska Company has also frequent applications from small towns throughout their territory for the establisbment of exchanges or for connection with the larger towns by means of extra territorial lines. Their gross receipts from extra territorial and toll lines already erected aggregate over $40 per mile per year, which is an exceedingly good showing. The company has under consideration at present the erection of a line from Crete to Hastings, a distance of 73 miles, connecting several thriving towns with Lincoln and Omaha. Also a line from Seward to Columbus, 55 miles; one from Fremont to Lincoln, 63 miles; and also an exchange at Norfolk, which will form a nucleus for a system of extra territorial lines centering at that place. The outlook for business throughout the whole State of Nebraska is exceedingly good; in fact, there is a larger demand than the Telephone Company are prepared to meet. Two sleet storms occurring in March, covering the whole of their territory, inflicted very serious damage, but they expect to have all their lines in first-class order again by the 1st of May, and to be giving their usual good service. The business of the Nebraska Telephone Company has always been conducted in a very conservative manner: and, with the exception of only three quarters, dividends at the rate of two per cent. per quarter have been regularly paid since the organization of the company in 1882. The capital stock of the company is $642,000. This is a very low capitalization, inasmuch as the company is possessed of a thoroughly good plant covering 700 miles of extra territorial and toll lines, and supplying 3,400 subscribers. It will be seen, therefore, that their capitalization is far below the average, and that when they resume dividends again, which will be very shortly, they will be in a position not only to pay the same regularly, but also to carry forward the work of extension.

BOISE CITY, Idaho.

The Capital Electric Light, Motor and Gas Company has a plant consisting of two Edison dynamos, 26 ampères, 600 volts each, driven by a 13-inch turbine wheel under 60 foot head. The plant was installed in July, 1887. It is now taxed to nearly its full capacity of 350 lamps of 16 c. p., and is netting a handsome revenue for its owners, having paid 10 per cent. dividends on the first nine months' operation. The capital stock is $10,000. Mr. W. H. Nye is the president, Mr. W. H. Ridenbaugh vice-president, Mr. J. Huntoon treasurer, and Mr. J. W. Cunningham secretary and manager. The plant is situated more than a mile from the centre of distribution, and the lamps, of 110 voltage, are placed in series of 5. The enthusiasts on the subject of electricity never expect to see gas introduced in this young city. No motors have yet been put in. Boise City has also a telephone exchange of about fifty subscribers, and a line is in course of construction to Silver City, a distance of 70 miles.

CAÑON CITY, Col.

The use of electric motors promises to increase greatly in this section. The Cañon City Coal Company are contemplating the putting in of electric motors and electric lights at their coal mines here. The motors will be used for the propulsion of coal cars, and the lights for the various workings of the mines. An agent of the company has been sent East lately to look up the subject. These mines are very extensive, and their product is shipped to all points in Kansas, Nebraska, Colorado and Texas.

NEWHALL, Cal.

There is not much electrical interest to record here. The only new work during the present year, so far, has been the putting up of 14½ miles of telephone line by the Pacific Coast Oil Company, with seven instruments, for private use. The Mission Transfer Company, of Santa Paula, Ventura County, is preparing to put in some 30 or 40 miles of telephone circuits.

MARYSVILLE, Cal.

The Marysville electric light plant was put in operation by the Marysville Coal and Gas Company January, 1887. The city granted the company a contract to supply 17 lamps of 2,000 candle-power for two years at a cost of $255 per month, commencing April 1. The plant consists of two No. 7 Brush dynamos, propelled by a Valley "Favorite" automatic cut-off engine. The commercial lighting consists of 24 lamps on two circuits one extinguished at ten o'clock, at a cost of $2 50 per week, and the other at one o'clock, at a cost of $3.50 per week.

WOODLAND, Cal.

In January, 1886, Mr. O. I. Cheyney came to this place, and succeeded in starting an electric light company, using Thomson-Houston apparatus. The plant now has a capacity of 100 lights, and is in the very best shape. The course of events is thus given by the Woodland *Mail* of April 8: "In January of this year Mr. Cheyney entered into negotiations for the lease of the gas works, but soon after, before the lease was effected, the principal stockholders of the electric light company secured by purchase the controlling interest in the gas works on Mr. Cheyney's proposition to also lease and guarantee a reasonable income on the investment. Following came the reincorporation of the two companies under the name of the Consolidated Electric Light, Gas and Power Co., with a capital stock of $35,000, and all the property of the corporation has gone into Mr. Cheyney's hands to manage under his lease for a term of years. Since assuming control of the gas works department Mr. Cheyney has shown no disposition to abuse the position he is in by running prices to a fancy figure; but rather he is sensible and just enough to derive only a fair compensation for his services and risks. He owns a large interest in the stock of the company and feels a deep concern in the whole enterprise as well as in his own behalf. Having purchased property in Woodland he intends to remain here, and wishes and well deserves the good opinion of the people, as well as their patronage. Mr. Cheyney is a young man and it is commonly said that he is one of the hardest working men in Woodland, his arduous duties requiring long hours and close attention, being on duty from 7 o'clock in the morning to 12 o'clock at night. He is a thorough engineer and electrician, and perfecting himself as rapidly as possible in the knowledge of the production of gas, possessing a large and complete library by the foremost scientists on the two illuminations of gas and electricity. He is one of the most successful young men we know of, and the ability displayed in the control and management of so much property is no small compliment to a young man who is not yet thirty years of age."

SANTA BARBARA, Cal.

The Santa Barbara Electric Light Company was incorporated on November 1, 1887, with a paid-up capital of $30,000. It uses the Thomson-Houston system, running about 125 arcs and 50 incandescents, all on the same circuits. The city pays for 37 street lights. The company now have their entire capacity engaged, and are taking steps to raise $20,000 more for the needed increase of the plant. The officers are S. W. Backus, president; C. Fernald, vice-president; W. H. Nixon, secretary; W. M. Eddy, treasurer; and L. W. Sanborn, business manager.

SAN FRANCISCO, Cal.

Mr. W. C. Clark, the agent here of the Waterhouse Electric and Manufacturing Company, of Hartford, Conn., has just equipped the Southern Pacific Company's ferry-boat "Piedmont" with a Waterhouse plant of 140 incandescent lamps of 20 c. p. Steam for power is supplied to a special "Ide" engine. The light is perfect, and the plant is giving great satisfaction. He is also placing in the Southern Pacific Railroad shops at Sacramento, Cal., a 30-light arc plant. Another piece of work he has in hand is furnishing a 10-light arc plant of the Waterhouse system, which has been contracted for by Livermore, Cal., for street lighting. The lamps will hang from masts 50 feet high.

COLFAX, Wash. Ty.

Mr. C. B. Hopkins, the manager of the Bell telephone system in Eastern Washington and North Idaho, is a licensee from the Sunset and Rocky Mountain companies. He now has some 400 miles of long distance line taking in all the leading towns in the district, with exchanges at Colfax and Walla Walla. He is using the Hunning transmitter with perfect success. He has now completed the organization at Colfax of a company which will put in an electric light plant of 200 lamps of 16 c. p., within the next three months. The capital stock is $12,000, and the Indianapolis Jenney system will be used. Mr. Hopkins will represent the system in this section.

SOUTHERN NOTES.

BALTIMORE, Md., April 23, 1888.

I send you herewith a clipping from the Baltimore *American*, with an account of the run of the storage car equipped with Sprague motors. Since the article was written, the car has run about 150 miles, over the worst roads that could be found in the city, with a crowd of passengers every trip, and the only expression was: "You have found the coming power; it is here." There has not been a single hitch. This success must be very gratifying to Mr. A. G. Davis, who has held on through five long weary years, since the first Faure cells were brought here, has worked hard, has spent money as liberally as he had it to spend, and has given his whole time to the matter. The clipping is as follows:

In February, 1883, the Electric Storage Company, of Baltimore, was formed, and Mr. James R. Clark, of this city, was made its president, and with him were associated the following gentlemen: Mr. Charles F. Dieterich, the well-known president of the Chesapeake Gas Company; Mr. Wm. S. Carroll, the president of the People's Bank; Mr. D. D. Mallory, capitalist; Mr. A. G. Davis, of the Viaduct Manufacturing Company; Mr. James L. McLane, Dr. Alan P. Smith, Mr. A. B. Proal, and later on, Mr. J. Frank Morrison. The first endeavor of these gentlemen was to demonstrate the practicability and advantages of electric lighting by means of the storage battery, and for that purpose they established a lighting station at 62 Baltimore street, and from it successfully lighted the stage, dressing rooms and immediate surroundings of the Academy of Music; the furniture establishment of Mr. Morton D. Banks; the office of the Franklin Bank; the office of the Telephone Exchange, in the American Building; Mr. H. D. Cook, 15 South street, and other places. This was continued for several months, but was abandoned for the reason that the projectors conceived that the time had not yet arrived at which lighting by electricity should take the place of lighting by gas; and further believing that the future of electric storage was in its use for power, and to which use none equaled the field of the propulsion of street cars, which, if it could be accomplished, would do away with the expense, noise and discomfort attendent upon the present method of drawing the same by horses.

During the last trip made Tuesday the car went easily over the steepest grades—such as those on Franklin street, between Greene and Fremont, and around the curves, and was stopped anywhere, even on a hill, whenever desired. Apparently all difficulties have been surmounted. This method of locomotion is much superior to power by cable, and there is far less likelihood of a failure in working. Experiments, with a view to trying it on our cars, have been going on for some time. Those interested in the matter were at one time ready to give it up as a failure. Mr. Wm. H. Donaldson, of the Viaduct Company, however, was convinced that it could be made a success, and energetically worked at it till it was shown, as on Tuesday, that it is entirely practicable. The batteries used were 10 horse-power, and were sufficient to run a car 40 miles. They were charged from the United States Company's Works.

BEAUMONT, Tex.

Messrs. Thomas & Gorman, who are general contractors here for civil and steam engineering work, are anxious to get bids for an electric light plant for this place, consisting of dynamos and detail apparatus. It should be capable of generating current for 600 incandescent lights, and the first order would include 10,000 feet of main wire, and 300 lamps with the necessary interior wire. They will furnish engine, boilers, all foundations, buildings, etc., and will erect the poles. The bids they ask are for the generating plant and main wire, all properly set up and in running order. Bidders should also state whether they will run arc lamps on the same circuit.

CANADIAN NOTES.

MONTREAL, Quebec, April 16, 1888.

Lighting Competition.

The Edison Company here has formally challenged the Royal Electric (Thomson Houston) Company to do battle in defense of the Sawyer-Man lamp. The Royal Company have, through their manager, Mr. Hagar, accepted the challenge, and are prepared to defend any and all purchasers of the Sawyer-Man lamp as used exclusively by the Royal Company. The sequel to this pass at arms lies, it is said, in the unsuccessful tenders of the Edison Company for several large plants which have been awarded to the Royal Company. The latter concern have been successful bidders for an increase in the Gazette Paper Company's plant. The Edison Company are, however, doing very fairly, notwithstanding the sharp competition.

Ahearn & Soper.

The United States Company are represented in Canada by Ahearn & Soper, of Ottawa, who are also dealers in electrical supplies. The Ottawa station under their management is run on the multiple series system from water power, and is a very creditable plant.

Alternating Currents.

The Royal Company are preparing, as soon as construction may be possible, to put up an alternating circuit in this city. The machine they will use has been built at their works here, under the direction of Mr. Fred. Thomson.

Subways.

At a recent meeting of the City Council the Dominion Subway Company applied for permission to open the streets of Montreal, for the purpose of laying a conduit system to receive all of the wires now on poles in Montreal. It will thus be seen that Canadians are keeping pace with the progress in electrical development as represented in the States.

The Federal Telephone Company.

The City Council at last week's meeting granted permission to the Federal Telephone Company to erect poles and wires in the streets of this city. They have been busy during the winter obtaining subscriptions for the proposed exchange. The Bell Telephone Company, under the able management of C. F. Sise, vice-president, have, however, had during the canvass a very decided increase in their subscriptions over the corresponding period of last year. Thus is exemplified the old adage, competition is the life of trade. The new company propose to open ground so soon as the violets grow.

Accumulators.

The Electrical Accumulator Company, of New York, have organized a company in Canada for the manufacture of their accumulator. The incorporators are C. F. Sise, T. Ahearn, W. Y. Soper, and others, who propose to push the accumulator business in Canada.

Fire Alarms.

The City Hall electrician, Mr. Badger, recently celebrated his twenty-fifth year as superintendent of the Montreal Fire Alarm, established by him. Mr. Badger is acknowledged an authority in electrical matters and especially in regard to fire alarm apparatus. He has recommended, as usual, in his annual report, an increase in the city fire alarm facilities, thus keeping abreast of the times—a thing the city authorities have not done. In consequence of their neglect Montreal has been tabooed by one or two insurance companies and an increase of 20 per cent. in rates has been declared by all other companies doing business here, to be maintained until the fire department shall be placed on a sound footing.

Telephone Manufacture.

The Bell Telephone Company's manufactory here is pushed to its utmost capacity in keeping pace with the rapid development of the company's business.

MT. ROYAL.

MEXICAN NOTES.

PUEBLA, Mexico.

It may interest your readers to know that a street lighting plant of 100 arc lights went into operation in this city on the 2d of April. The Thomson-Houston system is the one used. Power is furnished by a Leffel Twin turbine, using the water of the river Atoyac. The station is 7½ miles from the city, and is a substantial stone building. On the lower floor is the turbine and counter shafting, also a stable for horses. Above is the dynamo room providing space for five dynamos, of which number three are already in. In addition there are two or three smaller living rooms, quite necessary on account of the isolated situation of the station. The inauguration of the lights was made the occasion of a grand celebration, one enthusiast going so far as to write an ode in honor of the event, which was printed and industriously circulated. Compliments, in the shape of dinners, passed between the Electric Lighting Company and the authorities.

It is intended to push the commercial lighting, and as Puebla is a city of over 80,000 inhabitants, they will soon have a lighting plant here which will compare favorably with similar plants in the States.

THE TELEGRAPH.

Methuen, Mass., is to have a Gamewell fire alarm system.

Woburn, Mass., has appropriated $600 for new fire alarm signal boxes.

Brantford, Ont.—The city of Brantford desires to put in a fire alarm system of from 20 to 30 stations.

Greencastle, Ind.—A new electric fire alarm system is proposed for Greencastle. Mr. F. Wein is the chief engineer.

Reading, Mass.—Mr. E. C. Nichols, chief fire engineer, is to have an electric fire alarm system under his superintendence. It is to include nine stations, a whistle and bell.

Philadelphia Bucket Shops.—The Keystone Investment Company, the latest of the efforts to carry on a bucket shop business and having affiliations with a number of similar places in different parts of the country, has failed for $20,000.

Telegraph Litigation.—The New York Court of Appeals, sitting in this city last week, in the appeals of the Farmers' Loan and Trust Company, as trustee, versus the Bankers and Merchants' Telegraph Company, has dismissed both cases, with costs of each. The amount involved was about $350,000.

THE TELEPHONE.

A $5,000 suit has been brought against the telephone and electric light companies in Brooklyn by a boy who received a shock through treading on some fallen wires.

No Chewing Gum.—The Detroit *Journal* is authority for the statement that the young ladies in the local telephone exchange have been forbidden to chew gum during business hours.

Cleveland, O.—A verdict of $3,950 has been given in favor of Mrs. Sheffield, who sustained injuries by being thrown from her buggy against one of the poles of the Central Union Telephone Company, whom she thereupon sued.

Pins in Plenty.—The Gilliland Electric Company, of Adrian, Mich., recently shipped over 60,000 telegraph pins to the American Telephone Company for use in constructing the "long-distance" line from Albany to Buffalo."

A Bell Verdict.—A special dispatch from New Orleans of April 28 says: Judge Dare A. Pardee, of the United States Circuit Court, to-day rendered a decision on final hearing in the case of the American Bell Telephone Company et al. versus the National Improved Telephone Company in equity. The Court decides that the telephones used by the defendants are an infringement on the Bell patents, orders that all such instruments be delivered to the Clerk of the Court, subject to further orders, and gives the complainants judgment against the defendants for all costs, charges and disbursements in this suit. William Grant is appointed master to ascertain costs and damages.

Long-Distance Talk.—The Boston *News Bureau* says: Bell telephone people are considering their long-distance plans, and the talk of well informed telephone men is a scheme of "rights" to Bell telephone stockholders to subscribe annually at 50 for the next five years to Long Distance Telephone Company bonds, guaranteed by Bell Telephone Company and convertible into Long Distance Telephone Company stock, which stock, it is claimed, will be worth $150 per share. How much money per annum will be needed has now to be determined, but it may be said that the cost of long distance telephone construction is not far from $3,000 per mile.

Little Rock, Ark.—A special dispatch from Little Rock of April 21 says: The suit by the Bell Company to enjoin the Exchange operating the Southern Telephone Company at Little Rock, has been on trial here all the week before the United States Circuit Court, Judge Brewer. He delivered a long and very able opinion this morning, granting the injunction on the ground that the recent decision of the Supreme Court of the United States was conclusive on such a motion. He decided that the make and break theory advanced by the defendants was untenable and did not relieve them from infringement, and that the fact that the injunction was not asked for until after the Supreme Court's decision did not constitute undue delay in the complainants. Counsel for the Bell Telephone Company to-day filed a bill against the Bay Telephone Company for infringement of patent.

THE ELECTRIC LIGHT.

Rutland, Vt.—Bids for street lighting will be opened May 7.

Easthampton, Mass.—Bids will be received for street electric lighting.

Monteagle, Tenn., is to have electric lighting. The hotel will put in a plant.

Frederick, Md.—Mr. L. McMurray proposes to put a plant in his canning factory.

Birmingham, Ala.—The Birmingham Safe and Lock Company will put in a plant.

El Paso, Tex.—The El Paso Gas, Coke and Coal Company is to put in an electric light plant.

Middleboro, Mass.—A plant is to be put in at Middleboro. Mr. G. A. Cox is interested.

Nashville, Tenn.—A plant is to be put in at Glendale Park. Mr. J. E. Caldwell is interested.

Somerville, Mass., is to have an Edison municipal plant in connection with the arc service.

Louisville, Ky.—The Metropolitan Electric Light and Supply Company has been organized.

Chambersburg, Pa.—A complete electric light plant is wanted by A. W. McClement & Co.

Greenville, S. C.—A Brush plant of 60 arcs and 450 incandescents is to be furnished to the city.

Cape May, N. J.—The Franklin Electric Light Company has a three years' contract for street lighting.

Indianapolis, Ind.—Several companies are preparing to bid on the electric lighting of Indianapolis.

Oneida, N. Y.—Bids will shortly be invited for the street lighting. The present contract expires June 1.

Philadelphia, Pa.—A Loomis incandescent plant is being installed in the large bakery of Henry Wanklin.

Baltimore, Md.—The Brush Company will light Druid Hill Park with 18 arcs at 35 cents, on midnight schedule.

Olean, N. Y.—The Olean Electric Light and Power Company will put in a 650 light Westinghouse alternating plant.

Martinsburg, W. Va., is to have a Schuyler and Edison plant, under city contract to be executed within 90 days.

Topeka, Kan.—The Russell Electric Light and Power Company has been formed with a capital stock of $10,000.

Hagerstown, Md.—The Schuyler Company has sold a plant of 100 arc lights and 2,000 incandescents for Hagerstown.

New York City.—The bids for city electric lighting have all been rejected, and new bids are to be made until May 9.

Martinsburg, W. Va.—Contract has been made with L. N. Cox for a Schuyler plant of 45 arcs and 1,000 incandescents.

Shreveport, La.—The Shreveport Incandescent Electric Light Company has been formed with a capital stock of $10,000.

Everett, Mass.—A committee has been appointed to investigate the subject of electric lighting and to report at a future meeting.

Fort Worth, Tex.—The increase in the capital stock of the Fort Worth Gas and Electric Light Company is from $60,000 to $300,000.

Brockville, Can.—Forty arc lights are wanted for street illumination. Mr. J. Murray can furnish information as to the requirements.

Chicago, Ill.—The Park Manor Light and Heat Company has been incorporated by T. P. Keefe and others, with a capital stock of $5,000.

Davenport, Ia.—The Davenport Glucose Manufacturing Company are putting in a plant of 400 incandescent lamps of the Hawkeye system.

Wakefield, Mass.—The Wakefield Electric Light and Power Company, incorporated by G. H. Maddock and others, has a capital stock of $10,000.

Tuskaloosa, Ala.—Mr. W. C. Harris, Jr., has the contract to put in at once the plant of the newly organized Tuskaloosa Electric Light and Gas Company.

Pittston, Pa.—The Citizens' Electric Illuminating Company, of Pittston, Pa., has been incorporated by K. J. Ross and others, with a capital stock of $40,000.

Newport, R. I.—It is proposed to adopt the bids for street lighting of the Newport Incandescent El ctric Light Company. It is said that the company already has contracts for 1,000 lights.

Paterson, N. J.—Work has been in hand changing the electric plant to the Thomson-Houston system. The Paterson Electric Light Company has also received orders for nearly 3,000 incandescent lights.

Hastings, Minn.—The Hastings Electric Light and Power Company has been incorporated by J. T. Putnam and others with a capital stock of $15,000.

Johnson City, Tenn.—The new Johnson City Electric Light Company will put in a 35-arc Thomson-Houston plant. The officers are: J. J. Weiler, president; W. J. Thomas, vice-president; F. Evans, secretary; and M. I. Gump, treasurer.

Storm Lake, Ia.—Arrangements have been completed for making the electric light plant of J. Y. Skeels a joint stock company, and the capacity of the plant will be increased to 600 lights at once. The Hawkeye Company, of Oskaloosa, Ia., have the contract for the work.

Pawtucket, R. I., has been looking into the cost of electric lights, and finds that a plant of 250 arcs would cost about $50,000. This the city could run, it is claimed, at $80 per year per all night light. The Pawtucket Gas Company has put in bids for about 150 arc lights.

Montezuma, Ia.—A local company has been organized in this city and contract has been closed with the city for street lighting by incandescent lamps. The apparatus used will be that manufactured by the Hawkeye Electric Manufacturing Company, of Oskaloosa, Ia.

Cheyenne, Wyo.—The Brush-Swan Electric Light Company of Cheyenne is now running 100 arc lights and 3,000 incandescents. President Warren of the company has purchased control of the Cheyenne City Gas Company, and Mr. E. P. Roberts is the manager of both concerns.

The Heisler System.—Hyer & Montgomery, New York State agents for the Heisler system, have just closed a contract with the Johnstown, N. Y., Electric Light and Power Company for a plant of 500 lights of 30 c. p., to light a district embracing about twenty miles of circuit.

Middletown, Del.—The Edison Electric Light Company will put in a 60 h. p. boiler, 58 inches in diameter, and 15 feet long, and a 40 h. p. engine, to be furnished by the Harrisburg Car Manufacturing Company; also two new No. 6 Edison dynamos. The capacity of the new plant will be about 1,100 lights.

Livermore, Cal.—Mr. W. C. Clark, who represents the Waterhouse Company, of Hartford, Conn., has closed a contract with the town council of Livermore to light the place for three years. There will be nine lights of 2,500 c. p. placed on 50 foot masts in various parts of the town. A circuit will be run to Pleasanton.

Nashville, Tenn.—The Nashville Jenney Electric Light and Power Company has been fully organized with A. L. Landis, Sr., as president and with A. L. Landis, Jr., as secretary and treasurer. The right of way has been granted through the streets of Nashville, and the company will be prepared to receive bids for machinery, etc., within 60 days.

Fall River, Mass.—A special dispatch of April 25 says: The fire department was called to the Edison electric lighting station to-night about 11 o'clock, the building having been set on fire it is supposed by a short circuit. There were six dynamos and three engines in the building, which are probably useless. The loss is estimated at about $50,000, nearly covered by insurance.

Jerseyville, Ill.—The increase in the demand for the electric light service from the gas works has become so great that a new and larger building is to be erected for the plant, by Mr. E. J. King, the superintendent. In this building will be placed the present dynamos, of a total capacity of 65 arc lights, and a new one of 30 lights. To drive these will be put in an engine and two boilers; and it is later proposed to add an incandescent plant.

Henderson, N. C.—The Henderson Electric Light and Gas Company is to use the Thomson-Houston system with the Ball engine and boiler. It expects to have lights in service within two weeks. It will do both street and commercial lighting, and starts off with a good number of subscribers. It it now expecting to increase the plant within the next eight months, as the town is one of the most prosperous in the South and is growing very rapidly. Mr. J. D. Taylor is the Secretary and Treasurer.

Indianapolis, Ind.—The Jenney Electric Company, of Indianapolis, has recently doubled its capital stock. The additional amount has been taken in equal parts by the original incorporators, who are also the officers and constitute the directory. During the three years of its existence it has extended its business to all parts of the United States, and has of late made several foreign shipments. The capacity of the factory has never yet been equal to the demand for the apparatus there made.

A Pointer.—"Idler" says in the *Manufacturer's Gazette:* "Read in a paper this morning that an engineer who held a fine position in the city of Philadelphia was about to retire. His resignation was to be accepted when some capable man was found to take his place. The cause of this renewal was that the electric light having been introduced, a man who was 'up' in electricity, as well as in steam, was necessary to the position. Here is a tip for the young mechanic. In ten years from now every mechanic must possess a knowledge of electricity."

Pittsburgh, Pa.—The Pittsburgh *Gazette* of April 21 says: The Allegheny Council City Property Committee met last night for the purpose of taking action in regard to the petition of two electric light companies for the privilege of erecting temporary buildings in the First Ward, Diamond square. The companies asking this privilege were the Allegheny Illuminating Company (Schuyler system) and the Pittsburgh Electric Supply and Construction Company (Thomson-Houston system). The purpose of both companies was to furnish the streets and stores with light by new processes other than those at present in use, and sixty days' time was the limit desired for the buildings, after which the companies agreed to move them. A resolution was passed, granting both companies the rights asked, and also requiring an indemnity bond in $1,000 for infraction of the right granted. Many citizens of Allegheny and Pittsburgh were present at the meeting, the lobby being crowded with them.

APPLICATIONS OF POWER.

Staunton, Va.—The local Thomson-Houston Company will put in an electric road.

San Diego, Cal.—The Electric Rapid Transit Street Car Company's line is to be extended.

Sprague motors have just been shipped to Japan and to the Big Bend mining plant in California.

Augusta, Ga., will probably have an electric road in the National Exposition Grounds, of which Mr. Ryckman is the manager.

Chattanooga, Tenn.—The Highland Park & Chattanoga Railway Company may probably use storage. Their plans and work are now well advanced.

New York City.—The Rapid Transit Committee of the Real Estate Exchange reports in favor of electricity and the cable and calls for the exclusion of steam locomotives.

Bucksport, Me.—Wescott & Grindle's new pant factory at Bucksport, Me., has gone into operation with steam as the motive power, but it is intended to substitute electricity.

Wilmington, Del.—The Wilmington Railway Co. is so much pleased with the Sprague electrical equipment of its road that it has placed an order for more apparatus.

Los Angeles, Cal.—The erection of an electric power plant has been begun at Los Angeles. The building will be of brick, 100 × 100 feet, and two 500 h. p. engines will drive the generators, whose current will be used for stationary motors, cars, etc.

Davenport, Ia.—A Sprague electric road is to be put in at Davenport, to start with 8 cars, each equipped with two motors. It will be about 3½ miles long. The plant will also include an outfit of stationary motors of an aggregate of 100 h. p. for miscellaneous uses.

Springfield, Mo.—The Detroit Electrical Works have been granted a franchise for an electric railway for twenty years. Their Fisher system will be used. The road will be five miles long, and the whole is to be in the operation within a year. Two miles will be built at once.

Given the Preference.—We have as yet to hear that in a single instance the expense of the electric motors has prevented the traffic of any of the lines using them from being lucrative. Other things being equal, the public will always ride in electric cars in preference to horse cars.—*N. Y. Herald.*

Lafayette, Ind.—A contract has been closed with the Sprague Company for a three-mile road at Lafayette, with about four miles of track. The overhead system will be used. There will be 9 cars with twin motors. Provision will also be made for supplying about 100 h. p. of stationary motors for small manufactories, etc.

The C. & C. Motor.—The C. & C. Electric Motor Company have just issued a new illustrated circular on their motors, showing a number of new applications of small motors to the mechanical arts. Several of these applications have already been noted in our columns, and it is a pleasure to find the company making such rapid headway in its special line of work.

Meriden, Conn.—The lecture given by Mr. Leo Daft at Meriden, mentioned last week, was attended by no fewer than 1,500 people, one of the largest audiences ever drawn together in the town. The motor illustrations were followed with great enthusiasm, and the work of the Meriden Street Railway Company, which is putting in the Daft system, is being watched with the utmost interest.

Woonsocket, R. I.—Several days ago prominent members of the Thomson-Houston Electric Light and Power Company were in Woonsocket, R. I., in conference with the street railway directors, with a view to introducing their system of propelling street cars. Unless some such arrangement as the Light and Power Company proposes is made, there is a strong probability that Woonsocket will soon be without street car service, as the present system is far too costly for the patronage accorded the road the past few months.—*Mfrs. Gaz.*

Another Printing Press Run.—Mr. A. M. Webster, superintendent of the job printing department of the building in which the *Dry Goods Chronicle* is located, has put in a new Sprague motor to run the presses. This motor is automatic in regulation, and furnishes the same evenness of speed on a half-horse capacity that it does under full power, making it superior to any power yet utilized. Mr. Webster is up to the times in electricity. His distinguished namesake may have known more about constitutional power, but not as much as he does about the electric power that moves the world and turns out the thoughts of men by use of the modern printing press.—*N. Y. Dry Goods Chron.*

PERSONALS.

Mr. D. H. Bates has been appointed general manager of the Electrical Accumulator Company, succeeding Col. J. N. Keller.

Mr. F. B. Badt, who has been representing the United States Company in Chicago, will hereafter have his headquarters in New York, at the company's offices, 120 Broadway.

Mr. L. O. McPherson, who has charge of Prof. Elisha Gray's laboratory at Highland Park, has been securing additional machinery and power for that inventor's laboratory and shop.

Mr. F. G. Lyon, the superintendent of the Holmes Fire and Burglar Alarm Company, of New York, died recently in Jersey City of pneumonia, brought on by the blizzard. He was well known in electrical circles.

Mr. W. Blenheim, of the firm of W. Blenheim & Co., electrical engineers, of Egham, Surrey, England, is on a visit to this country, with the object more particularly of looking into bell, burglar, annunciator and fire alarm systems.

Mr. Charles Grover has been appointed general Southwestern agent for the Hawkeye Electric Manufacturing Company, of Oskaloosa, Ia. His office will be at 552 Main street, Kansas City. His experience and large acquaintance should render him valuable in this position.

Mr. Thomas Wood, of the Sandusky, O., Gas and Electric Light Company, has been elected President of the Ohio Gas Men's Association. He is an advocate of electric lighting, whose claims he presented again at the last meeting, being ably seconded in another paper by Mr. F. W. Day.

Prof. L. I. Blake, now of the Department of Physics, at the University of Kansas, proposes to make the electrical engineering course there similar to the one he established at the Rose Polytechnic Institute, at Terre Haute, Ind. The course was started by Prof. Nichols, who has succeeded Prof. Anthony at Cornell, and Prof. Blake took up the work last fall. He finds a general and warm welcome for the practical course that has been begun.

Sir John Pender was, we learn by cable, given a banquet last week in London at the Hotel Metropole, to mark his elevation to the dignity of Knight Commander of St. Michael and St. George. Among those who participated were the Postmaster General, the Dean of Westminster, the Earl of Derby, Lord Wolseley, Earl Galloway, the Marquis of Tweeddale, Lords Thurlow, Bury, Chelmsford and Hamilton, and several other persons with titles. The company numbered over two hundred, and the reception given to Sir John was most enthusiastic, every allusion to his great and distinguished services to the Empire and to telegraphy bringing out rounds of cheers. A portrait of Sir John was presented to Lady Pender. Addresses and telegrams of congratulation were read from Mayor Hewitt, Dr. Norvin Green, Mr. Cyrus Field, Mr. Erastus Wiman and others.

SPARKS AND FLASHES.

He Didn't Use a Phonograph.—"Have you ever met Brown, of Toledo?"

"No; I have never had that pleasure, although I have corresponded with him about business matters for five years."

"Brown is one of the worst stammerers I ever heard."

"Funny, I never noticed it in his letters."

A Poetic Thought.—Our wide-awake little boy, aged five years, wanted to know, during a thunder-storm, whether God was not angry "with the naughty people," and on being told yes, but that that was not the reason of the storm, he exclaimed: "Ah, I know! I guess it is the angels' horses running races on the dark clouds."—*New York World.*

Worked Successfully.—"How did that burglar alarm I sold you turn out?"

"Great."

"Worked very well, eh?"

"Yes, when it went off it alarmed everybody in the house so badly that the burglars got off with everything before we were over being rattled."—*Nebraska State Journal.*

New England Baldness.—A peculiar case is reported from Biddeford. An overseer in one of the mills there, in the course of his regular duties, is exposed to a strong electrical current, generated by the large belts in rapid motion near by. It seems that the electrical conditions are such as to have caused his fine head of iron gray to change to a beautiful bay. Some of his friends express their doubts of the cause of this singular change, but those best qualified to judge the matter account for it as above.—*Bangor Commercial.*

MISCELLANEOUS NOTES.

The Tesla Electric Company, of New York, has been organized with a capital stock of $300,000.

Removal of Factory.—The Eddy Manufacturing Company have moved from Hartford to Windsor, Conn.

Sioux City, Ia.—The Sioux City Electric Company has been incorporated by E. W. Rice and others, with a capital stock of $50,000.

Execution by Electricity.—The Society for the Prevention of Crime has petitioned the New York legislature against the adoption of execution by electricity.

Fort Worth, Tex.—The Fort Worth Electrical Construction Company has been formed by E. E. Chase, A. B. Smith, W. D. Littlefield and others. The capital is $25,000.

Conduits in New England.—The Committee on Mercantile Affairs has continued its hearings at the Massachusetts State House, Boston, on the subject of the proposed subway legislation.

Gloucester, Mass.—The Gloucester Electric Company has a capital of $20,000. Officers: William H. Jordan, president; Joseph O. Potter, treasurer; the same, William Thompson and Francis Proctor, directors.

English Electricians.—An English contemporary, *Invention,* has recently published a very fine cartoon giving the portraits of all the leading English electricians and electrical engineers. The sheet is a large one and the design, of emblematic character, is cleverly conceived and neatly worked out. *Invention* has published a long series of these "cartoons" of men distinguished in the arts and sciences, and they have all been excellent.

Prize Essay on Electro-Magnets.—A gold medal worth about $150 is offered by the Italian Society for the Advancement of Electrical Science for the best paper on electro-magnets, considered more particularly with a view to their application to dynamos. The paper must be written in either French or Italian, and should reach the executive committee before the 30th of October of the present year, accompanied by a device or motto, and a sealed envelope bearing the same device, and containing the name and address of the author.

Is the Subway Act Constitutional?—The constitutionality of the New York subway acts, imposing assessments on the telegraph companies, is now under consideration by Judge Barrett

of the Supreme Court. The Postal, the United Lines and the Commercial companies have applied for injunctions to restrain the collection of assessments under these acts. The cases were argued by Andrew Wesley Kent, counsel for the companies, and the Attorney-General in opposition, and briefs were submitted on April 28

Electrical Courses.—The announcement that an electrical training school is to be established at Frankfort, Germany, suggests the practicability of similar institutions in this country. At present some of the general technical schools have special courses in electricity, more or less thorough; but it is probable that with the rapid growth of the various electrical industries, special schools, as for mining, civil engineering, agriculture, etc., will in time spring up, in which scientific training in electricity will be the leading feature, and not made subsidiary to the other branches of technology.—*Engineering and Mining Journal.*

BUSINESS NOTICES.

The Partz Electric Battery Company, of 1,723 Chestnut street, Philadelphia, have three batteries which they make a specialty of, namely, a motor, acid gravity and open circuit. Send for their catalogue. The results of three years' use are simply marvelous.

Frames of every description for showcards and pictures can be had of William Levin, 37 Dey street. Quality and promptness guaranteed. Catalogue and estimates on application. A full line of elegant pictures low, for cash.

Change of Location.—Owing to increase of business and the consequent necessity of greater accommodations, the Chalmers-Spence Company will on May 1 remove their Chicago warerooms from 144 to No. 86 Lake street.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Hering's Principles of Dynamo-Electric Machines.—"'Hering's Principles of Dynamo-Electric Machines' is just the work I wanted. I think it is undoubtedly one of the most useful and practical books on electric lighting machines ever published, and should be in the hands of every electrician or any person very much interested in electric lighting. We feel very thankful to Mr. Hering and yourself for its publication."

W. O. COLEMAN,
Civil and Mechanical Engineer, West Point, Miss.

The Matchless Metal Polish Company, manufacturers of "Tripoline," used for cleaning and polishing in connection with electric lighting purposes, report shipments last week to the Western Light and Power Company, Toledo, Ohio; Toledo Electric Light Company, Toledo, Ohio; New Britain, Conn., Electric Light Company, and a number of others; also requests for samples from electric light companies at Salem, Ore.; Shreveport, La., and several others. They state that all reports thus far received pronounce the polish to be A 1 and as represented.

Hine & Robertson, 45 Cortlandt st., N. Y., are pursuing a novel method of inducing electric light companies to try "Eureka" Packing. To every new customer ordering direct from them 15 pounds or more at regular price, 75 cents per pound, they will send a handsome 8-day calendar clock, 12 in. dial, 24 in. high, or set of brass oilers and tray, 6 pieces, best made. This is an easy way to secure one of these necessary articles and get a packing indorsed by the most prominent electric light plants.

Hering's Principles of Dynamo-Electric Machines.—"I feel assured that 'Hering's Principles of Dynamo-Electric Machines' will prove a decided help, particularly to students of electrical engineering who are designing and constructing dynamo machinery for experimental and testing purposes, and who need practical rules. I shall use it with 'Thompson's Dynamo-Electric Machinery' for our second year students in the electrical engineering course here." L. I. BLAKE, Prof. of Physics,
University of Kansas, Lawrence, Kans.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 24, 1888.

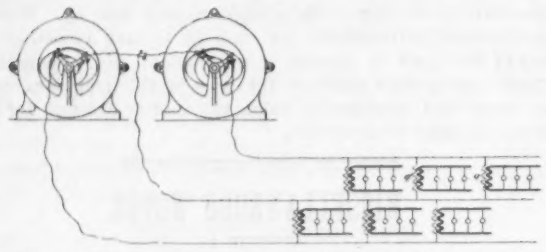
381,531. Telephone Receiver; William H. Collins, Chicago, Ill., Assignor of one-half to Jacob Kirkner, of New York, N. Y., and Robert Bines, of Chicago, Ill. Application filed March 11, 1887. The first claim is as follows: In a telephone receiver, the combination with a vibratory diaphragm of magnetic material, of a soft iron core, a coil of primary wire surrounding said coil and suitably connected to a battery or other source of electricity, and a coil of secondary wire surrounding said primary connected to the line, and having its end surface exposed to the diaphragm, and exerting a magnetic influence thereon, substantially as and for the purpose specified.

381,542. Solution for Voltaic Batteries; Chas. E. Egan, Columbus, Ohio, Assignor by direct and mesne assignments to Wm. Y. Miles and S. W. Smith, both of same place. Application filed Sept. 8, 1887. The solution contains ferric sulphate and a chromic compound.

(1) 381,555. (2) 381,556. Electric Railways; Rudolph M. Hunter, Philadelphia, Pa., Assignor of both to the Electric Car Company of America, same place. Applications filed respectively Oct. 4, 1886 and July 19, 1886. (1) An arrangement of conductors whereby the total resistance offered to the current in completing its circuit through the motor, be it close to or a long distance from the generator, is constant and fixed. (2) A conduit having an inner chamber for the conductors and an outer chamber for water. The construction is such that the surface water will fall into the outer chamber before reaching the slot.

381,568. Steam Dynamo-Electric Machine; Richard H. Mather, Windsor, Conn. Application filed Aug. 19, 1886. A rotary steam engine is built inside of the armature and drives the same to generate electricity. Steam enters through the shaft of the engine. See page 225 this issue

381,576. Electric Signaling Apparatus; Myron W. Parrish, Detroit, Mich., Assignor to the Parrish Bros. & Peck



381,794. TRANSFORMATION AND DISTRIBUTION OF ELECTRIC ENERGY.

Electrical Company, same place. Application filed Aug. 3, 1887. Details relating to train signaling.

381,585. Trap for Electric Railway Conduits; Wm. M. Schlesinger, Philadelphia, Pa. Application filed May 29, 1886. The trap is so constructed that parts of it may be removed for the insertion of the plow without interfering with the conductors.

381,614. Electric Light Carbon; Thomas Lanier Clingman, Ashville, N. C. Application filed May 14, 1887. Powdered serpentine is commingled with the composition of the carbons.

381,636. Armature for Dynamos; Moritz A. Müller, Newark, N. J., Assignor to the United States Electric Lighting Company, of New York, N. Y. Appplication filed Oct. 17, 1887. This invention relates to that described under number 381,700, and consists in substituting pins or plugs for the cleats or guides. See illustration.

381,650. Electric Motor for Railways; Sidney H. Short, Denver, Col., Assignor to the United States Electric Company, same place. Application filed Sept. 22, 1885. The current gatherer is pivoted to a block connected with the motor by bolts and springs.

381,669. Combined Station Indicator and Signaling Apparatus for Railway Trains; John H. Bickford, Salem, Mass. Application filed Nov. 26, 1886. An electric circuit composed of two battery lines, and two indicators located in a single car, one placed in each line. A switch is arranged for cutting out the rear indicator.

381,693. Electric Alarm for Ships' Compasses; Augustus Gross, Newcastle, New South Wales. Application filed Oct. 11, 1887. An alarm is placed in electrical connection with the "course setters" of a mariner's compass, and arranged so that any deviation of the ship from the course will be indicated by the alarm.

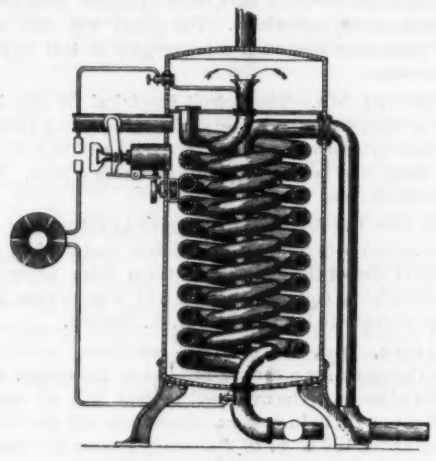
381,700. Armature for Dynamos; John F. Kelly, New York, N. Y., Assignor to the United States Electric Lighting Company, of same place. Application filed Oct. 17, 1887. Series of cleats, stops or guides are located at the ends of the core, and insulated conductors are wound longitudinally upon the core and around or through the stops or guides.

381,709. Annunciator and Signaling Apparatus; Morris Martin, Malden, Assignor of one-half to Chas. Follen Adams, of Boston, Mass. Application filed June 14, 1886. The operation of a key short-circuits a resistance and throws into view an annunciator.

381,725. Electric Door Opener; John Schneider, New York, N. Y. Application filed June 10, 1887. Structural details relating to door openers.

381,736. Electric Indicator; Edward Weston, Newark, N. J. Application Aug. 13, 1887. The core of the solenoid is mounted on springs so arranged that it may move in a longitudinal direction but not laterally.

381,764. Telegraphy; Patrick Bernard Delany, New York, N. Y. Application filed Dec. 17, 1887. In working over long cables the period of contact of the trailer with a segment is found to be too short to fully charge line. The movement of the trailer is, therefore, controlled by an escapement.



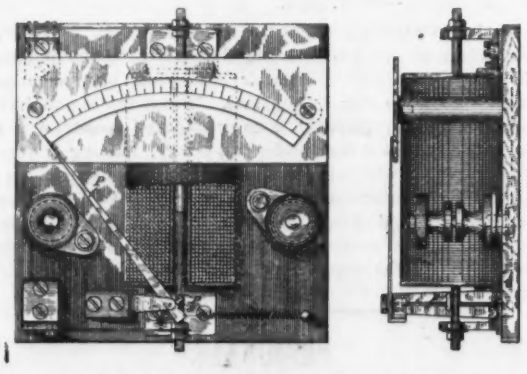
381,818. METHOD OF ELECTRO-CHEMICAL HEATING.

381,765. Electric Bell; Constant F. De Redon, New York, N. Y., Assignor to Pearce & Jones, of same place. Application filed Feb. 20, 1888. The mechanism is covered by the gong and the core of a single magnet is the supporting pillar of the gong.

381,768. Regulation of Electric Motors; Stephen Dudley Field, Yonkers, N. Y. Application filed Aug. 13, 1887. The field magnet is constructed with separate coils, any number of which may be included in circuit at will. Adjustable commutator brushes are provided, the positions of which are dependent upon and determined by the number of field magnet coils in circuit. A single lever changes the position of the brushes and the circuit connection of the field magnets.

381,772. Electric Annunciator; John Geary, Philadelphia, Pa. Application filed Oct. 25, 1887. The shaft carrying the pivoted pointer is journaled in the armature of the magnet.

381,780. Electrical Measurement Apparatus; Hammond V. Hayes, Cambridge, Mass. Application filed April 22, 1887. Claim: An instrument for the comparative measurement of electrical currents, comprising, in combination, a single coil or helix in a circuit conducting a current to be measured or compared, an additional coil or coils in a circuit including a receiving-telephone, a support for said coils, and means whereby one coil can be moved toward and away from the other until a point is determined where the current in the first coil ceases to act inductively on the second coil or coils.



381,736. ELECTRIC INDICATOR.

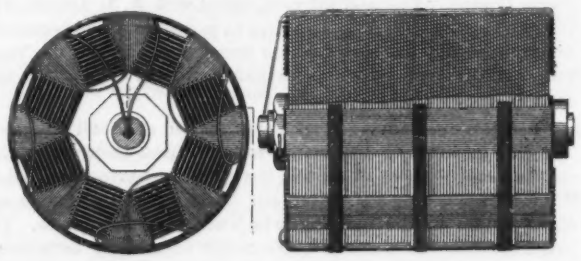
381,789. Dynamo-Electric Machine and Motor; Moritz Immisch, London, County of Middlesex, England. Application filed Dec. 23, 1886. Patented in England March 2, 1886, No. 2,956; in France March 24, 1886, No. 174,998; and in Belgium March 25, 1886, No. 72,498. The coils of the armature are divided into two circuits. There are two commutators, with one brush to each. The alternate coils of the armature connect with the segments of one commutator, while the remaining coils connect with the other commutator.

381,794. Transformation and Distribution of Electric Energy; Rankin Kennedy, Glasgow, County of Lanark, Scotland, Assignor of one-half to Robert Dick, of same place. Application filed Dec. 29, 1886. This invention has for its object the saving of prime cost in laying down the main supply conductors, and comprises the supplying of high potential alternating currents of electric energy for operating secondary generators in great numbers from a central supply station. According to one arrangement of the invention there is used in combination with two main current transformers having their secondary wires joined in series order, a system of main conductors known as the "three-wire system," and hitherto practiced for the purpose of distributing low potential currents directly to the lamps or other translating devices. See illustrations.

(1) 381,815. (2) 381,816. (3) 381,817. (4) 381,818. (5) 381,919. (1) Heating by Electricity; (2) Electric Heating Apparatus for Railway Cars; (3) Electric Heating System; (4) Method of Electro-Chemical Heating; (5) Heating Railway Cars by Electro-Chemical Means; Elias E. Ries, of Baltimore, Md., Assignor of one-half of each of the above patents to Albert H. Henderson, of same place. Applications filed respectively, Feb. 9, 1887; Feb. 9, 1887; June 27, 1887; June 22, 1887, and June 28, 1887. Transformers are used in connection with generators of high-tension currents to convert them into currents of low E. M. F., but great intensity. The several patents relate to the different means for utilizing the transformed currents to best advantage in different places.

381,823. Electrical Bell or Mechanical Striker; John H. Bickford, Salem, Mass. Application filed May 31, 1887. Clock work and spring power are utilized to strike a single blow on the gong when it is released by a controlling magnet.

381,839. Dynamo Telegraphy; Francis W. Jones, New York, N. Y. Application field July 13, 1887. Claim: The combination with a key, having separate connection from its back and front contacts, respectively, of dynamo machines of



381,636. ARMATURE FOR DYNAMOS.

opposite polarity in said connections respectively, and a tension-changing transmitter having two sets of simultaneously acting contacts placed in said connections, respectively, for varying the amount of electric energy, irrespective of the position of the key.

381,852. Electric Fire and Burglar Alarm; Andrew Schuchman, Springfield, Ill. Application filed Nov. 29, 1887. A spring-actuated rotatable disc has wound upon it a destructible cord which holds the spring taut. The disc has a contact point which will make connection with a contact on the casing when the disc is rotated. The destruction of the cord allows the contacts to come together and complete an alarm circuit.

381,856. Electrical Apparatus; Clarence C. Sibley, New York, N. Y., Assignor to The New Haven Clock Company, New Haven, Conn. Application filed Nov. 23, 1886. An escapement mechanism for regulating the interval between the vibrations of an automatically vibrated armature.

381,862. Suspended Cable and Electrical Railroad; George R. Taylor, Louisville, Ky., and Wm. Heckert, Yonkers, N. Y. Application filed Dec. 2, 1885. An elevated tunnel having a track within it from which the cars are suspended, the tunnel also carrying the cable or conductor furnishing the power to drive the car.

381,866. Electrical Method of Automatically Controlling the Supply of Water or Gas; Leopold Weil, of New York, N. Y. Application filed July 22, 1887. Means for automatically closing the gas or water supply pipes when some act is done which must of necessity be done in order to close the building when business is suspended for the day. The locking of a desk for instance or the removal of a door key from its hook will close a circuit controlling the valves.

381,896. Automatic Fire-Alarm System; John Young, Chicago, Ill. Application filed April 28, 1884. A high resistance sounder and a key are located in the circuit of a building back of the thermostats. By closing the circuit with the key the line may be tested without ringing an alarm.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.